

ARAB REPUBLIC OF EGYPT

**INTEGRATED WATER RESOURCES
MANAGEMENT PLAN**

Prepared by

THE MINISTRY OF WATER RESOURCES AND IRRIGATION

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INTEGRATED WATER RESOURCES MANAGEMENT PLAN

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Acronyms and Abbreviations

BCM	Billion cubic metres
BCWUA's	Branch Canal Water User Associations
BOT	Build, Operate and Transfer
C&C	Communication and Coordination
DRI	Drainage Research Institute, NWRC
DSS	Decision Support System
DWB	District Water Board
EEAA	Egypt's Environmental Affairs Agency
EPADP	Egyptian Public Authority for Drainage Projects
FAO	Food and Agriculture Organization
FTC	Facing the Challenge strategy
GAFRD	General Authority for Fish Resources Development
GoE	Government of Egypt
GWS	Ground Water Sector, MWRI
HAD	High Aswan Dam
IAS	Irrigation Advisory Services
IIP	Irrigation Improvement Project
IIIMP	Integrated Irrigation Improvement Management Project
IMT	Irrigation Management Transfer
IWMD	Integrated Water Management District
IRU	Institutional Reform Unit
IWRM	Integrated Water Resources Management
IWMGD	Integrated Water Management General Directorate
MALR	Ministry of Agriculture and Land Reclamation
M&E	Monitoring and Evaluation
MHUNC	Ministry of Housing, Utilities and New Communities
MoHP	Ministry of Health and Population
MoI	Ministry of Industry
MoSEA	Ministry of State for Environmental Affairs
MoT	Ministry of Transport
MWRI	Ministry of Water Resources and Irrigation
NBI	Nile Basin Initiative
NAWQAM	National Water Quality and Availability Management
NOPWASD	National Organisation for Potable Water and Sewage Disposal
NWRC	National Water Research Centre, MWRI
NWRP	National Water Resources Plan
O&M	Operation and Maintenance
PPP	Public Private Participation
RWMA	Regional Water Management Administration
SRU	Strategic Research Unit (NWRC)
SWERI	Soils, Water and Environmental Research Institute, MALR
USAID	United States Agency for International Development
WB	Water Boards
WUA	Water Users Association
WWTP	Waste Water Treatment Plant

Executive Summary

The challenges facing the water sector in Egypt are enormous and require the mobilization of all resources and the management of these resources in an integrated manner. It is believed that *business-as-usual* scenarios are no longer adequate in meeting the current challenges. Changes in the way water resources are currently allocated and managed are inevitable. Accordingly, the Ministry of Water Resources and Irrigation has recently launched a National Water Resources Plan for Egypt (NWRP). The NWRP is a comprehensive document which describes how Egypt will safeguard its water resources in the future, both with respect to quantity and quality, and how it will use these resources in the best way from a socio-economic and environmental point of view. The NWRP needs to be augmented by a transitional strategy including further reform interventions which ensure smooth and enhanced streamlining with Integrated Water Resources Management principles and approaches.

The current IWRM Plan has been prepared to serve the later concerns and is intended to be a complementary, action-oriented, implementation framework to the NWRP. It addresses the gaps in NWRP and provides for additional measures and provisions which facilitate the transition towards an integrated management approach within the water sector. The IWRM Plan assesses the current water resources management setup and practices along with the ongoing reform efforts led by the MWRI. The Plan identifies the actions agreed upon as major interventions to pursue an effective integrated framework for water management over the next 15 years.

Thirty Nine actions are proposed to fulfill the transition *Towards Streamlining the Current Trends and Practices into an Integrated Water Resources Management System for Egypt.* The actions are prioritized and scheduled according to short, medium and long term implementation. The actions fall under eleven major categories with several interventions within each category. These are:

- Institutional Reform and Strengthening
- Policies and Legislations
- Physical Interventions
- Capacity Building
- Technological and Information Systems
- Water Quality
- Economic and Financial Framework
- Research
- Raising Awareness for IWRM
- Monitoring and Evaluation
- Trans-boundary Cooperation

A technical secretariat will be established within MWRI to follow up on the implementation of the IWRM plan, coordination and communication among various stakeholders within the water sector and pertaining to different interventions.

Chapter 1

Background and Context

Integrated Water Resources Management (IWRM) is the process through which water and land resources are managed and developed within a coordinated framework in order to maximize economic and social welfare and ensure equity and sustainability of environmental systems. IWRM seeks a holistic/integrated approach to management of water and is as concerned with management of demand as with its supply.

1.1 Challenges and Responses

The history of water resources management in Egypt extends back to the time when the first ever known aqueduct was built. At present, there are significant challenges to water resources development and use in Egypt. Beginning with a single source of water – The Nile – uncertainties in climate, developments upstream, and population growths have characterized efforts to anticipate potential future water constraints. Municipal and industrial water use is being readily met and agricultural water use yields high levels of production with about 200% cropping intensity. However, the costs for water services for the next 15 years will be more than triple the current expenditures. Future public sector allocation for such high costs presents a heavy and unsustainable burden for the government budget. Moreover, water quality in a closed system is deteriorating because of pollutants being retained in as part of the recycling and reuse of drainage water, along with poor treatment and regulation of urban and rural sanitation. Stakeholders at the local level are organizing water users associations and water boards to confront the issue and have their voices heard on irrigation and rural sanitation issues.

Thus, the main drivers for water management reform at both the central and regional levels include (i) the need to meet supply/demand imbalances for the future; (ii) water quality deterioration and associated health and environmental risks; and (iii) weak service delivery, reliability, and transparency and associated quantity and quality measurements along with financial sustainability and cost recovery issues.

In addressing the main issues and the way forward, The Minister of Water Resources and Irrigation has stated that:

*“...the challenges facing the water sector in Egypt are enormous and require the mobilization of all resources and the management of these resources in an integrated manner. This is especially true as the amount of available water resources is fixed, meanwhile water demands continue to grow in the years ahead due to population growth, increased food demand, and expansion and modernization of the industrial base, and improved standards of living..”*¹

¹ Seminar on Implementing Integrated Water Management in Egypt, Agenda and Briefing Notes, 12-13 June 2003, p. iii.

In essence, the challenges faced by the Government of Egypt include meeting the water demands of a growing society, rising living standards, food policy to feed a growing population, water quality degradation and environmental problems and health issues. Given a constant supply and growing demand, there is increasing competition for water from multiple uses. These challenges necessitate changes in the way water is currently allocated and managed. Consequently, the Ministry of Water Resources and Irrigation has prepared a National Water Resources Plan for Egypt (NWRP, 2004) that focuses on the physical improvements necessary to satisfy the supply-demand imbalance. The totality in the approach to water resources/agricultural/urban water management is expressed throughout the plan.

The NWRP needs to be augmented by a transitional strategy including further reform interventions which ensure smooth and enhanced streamlining with IWRM principles and approaches. Moreover, the GOE is working towards achieving the Millennium Development Goals and complying with the call of the World Summit on Sustainable Development (Johannesburg 2002) for all countries to develop integrated water resource management and water efficiency plans by 2005.

1.2 Integrated Water Resources Management Process

At the request of the Government of Egypt (GOE), the World Bank has initiated a series of consultations to identify means to integrated water resources management by building on the messages of the World Bank Water Sector Strategy of 2003. Within this context, the Ministry of Water Resources and Irrigation and the Bank have conducted a 2- year rigorous consultation process at the national, regional, and local levels as part of strategic engagement in IWRM to examine the enabling regulatory, institutional, and stakeholder environment for IWRM implementation. The scope of consultations focuses primarily on holistic resource management and financial sustainability. A national level workshop has been held at Alexandria, in May 2004 to provide a forum for stakeholder discussions on key integrated water management issues and action plans emanating from a series of studies. The workshop is followed by an extensive round of stakeholders' consultations to discuss and agree, within a participatory perspective, the required interventions.

Several studies have been conducted during the consultation process and basic documents have been used as references to this plan. These include:

- IWRM: Financial Sustainability Report, January 2004
- Holistic Approach to Water Resources Management; Stock-taking of IWRM in Egypt: policy and practice, February 2004
- Integrated Water Resources Management Synthesis Note, May 2004.
- IWRM Workshop, Proceedings, Alexandria, April 2004
- Integrated Water Resources Management Implementation Note, August 2004.
- Study on Cost Recovery in the Irrigation and Drainage Sector, September 2004.
- IIIMP Project Appraisal Document, Draft, January 2005
- Public Expenditure Review, Part I, January 2005.
- Rural Sanitation Strategy, February 2005.

The efforts have culminated in the production of the current IWRM Plan which is viewed as a complementary, action-oriented, implementation framework to the NWRP. It addresses the

gaps in NWRP and provides for additional measures and provisions which facilitate the transition towards an integrated management approach within the water sector. Reflecting the dynamic and interactive spirit of IWRM, the plan will be reviewed, evaluated, and adjusted periodically throughout its course of implementation.

1.3 Organization of the Document

Following this introduction, the document is organized as follows:

- **Chapter 2** places the central water quantity, quality, institutional development, and financing of the sector in context
- **Chapter 3** presents the experiences of reform efforts to date and MWRI's vision for water management in the country over the next two decades.
- **Chapter 4** identifies the actions agreed upon as major interventions to pursue an effective integrated framework for water management over the next 15 years.

Chapter 2

Current Water Resources Management Setup and Practices

2.1 Freshwater Supply

The overall average annual rainfall in Egypt is about 18 mm mainly occurring at the northern coast which receives about 150 mm of precipitation per year. In the southern Upper Egypt, Sinai, and along the Red sea coast events of measurable rainfall may be encountered once every three years, sometimes developing into very short, but destructive, flash floods. Precipitation which occurs in winter and late autumn accounts for 1.3 BCM/yr of internal renewable water resources recharging shallow aquifers, and to a less extent supplying surface water resources.

The Nile River supplies about 97 % of the annual renewable water resources in Egypt. Out of the Nile's average natural flow of 84.0 km³/y reaching Aswan, a share of 55.5 BCM/yr is allocated for Egypt according to the Nile Water Agreement (1959). The Agreement also allocates a share of 18.5 BCM/yr to Sudan; while about 10 BCM/yr is lost in evaporation from the high dam reservoir (Lake Nasser). Thus the total renewable water resources of Egypt are estimated at 56.8 BCM/yr. (Some references include an additional 1.0 BCM/yr of transboundary groundwater flow [FAO 1998]). The latter amount of supply is constant and incremental possibilities are not foreseen for the short term. This accounts for an average per capita share of about 800 m³/cap/y as of year 2004, while projections forecast a share of about 600 m³/cap/y by the year 2025 as depicted in Figure 1.

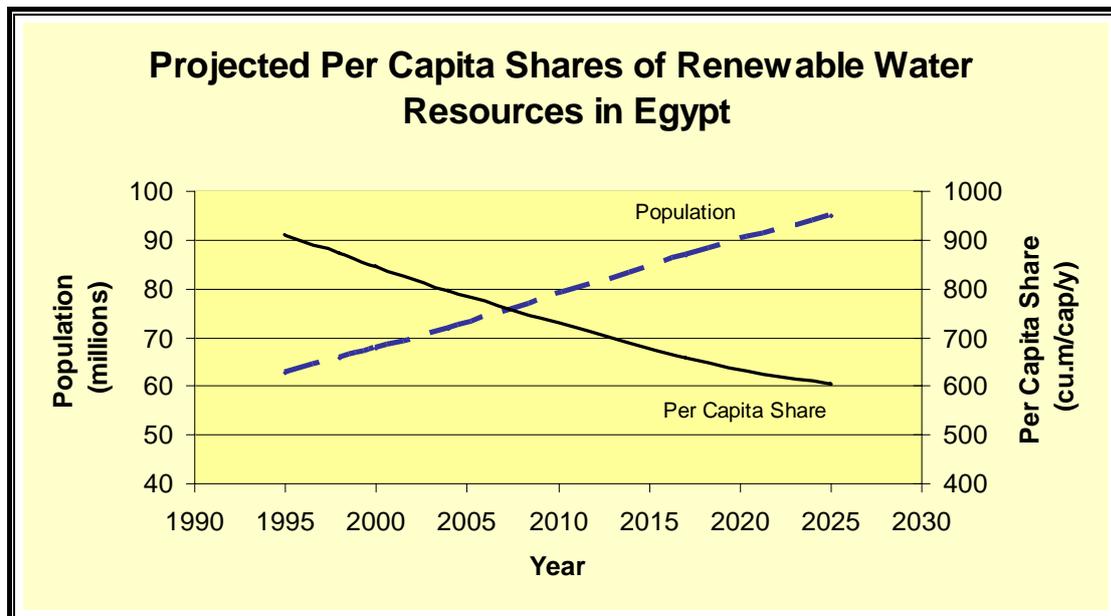


Figure 1. Projected Annual Per Capita Share of Renewable Water Resources in Egypt

Non-renewable water resources comprise fossil groundwater in deep aquifers. Non-conventional resources include agricultural drainage water reuse, sea water desalination, brackish water desalination, municipal wastewater reuse, and rain harvesting. Fossil water exploitation is estimated at a rate of 1.0 BCM/yr, mainly concentrated at the oases of the Western Desert. The municipal wastewater reuse capacity is currently of the order of 0.7 BCM/yr, while the agricultural drainage reuse is projected to be around 7.5 BCM/yr in the Nile Valley and delta. Reused water is a recycled bi-product of other water utilization sectors. It should be viewed as a demand management intervention and should not be accounted for at the national balance of natural resources.

Groundwater utilization has been steadily increasing in Egypt for the last twenty years. A designated sector for groundwater management has been established at the Ministry of Water Resources and Irrigation to coordinate, develop, and rationalize the national groundwater utilization. There are four major groundwater systems in Egypt, namely; the Nile Aquifer, the Nubian Sandstone Aquifer, the Moghra Aquifer, and the Coastal Aquifer. The Nile aquifer is renewable and underlies the Nile Delta and is characterized by high productivity of its wells and the shallow depth of the groundwater table allow the abstraction of large quantities of water (100-300 m³/hr) with relatively shallow wells at relatively low pumping cost. Conjunctive use of surface and groundwater is widely practiced by farmers, especially during periods of peak irrigation demands. About 6.1 BCM/yr are annually extracted from the aquifer. Being a shallow aquifer it is extremely vulnerable to pollution by surface induced sources. The aquifer is directly connected to the Nile River system, and thus will be directly affected by programs for reducing conveyance losses in waterways. The Nubian sandstone aquifer is shared by four countries namely; Egypt, Sudan, Chad, and Libya. The whole aquifer contains about 150,000 BCM of fossil water at depths reaching 2000 m. Pumping costs and economies of scale control the development of groundwater from the Nubian Aquifer. The Nubian Aquifer extends also beneath the Eastern Desert. Recent studies show that the shallow aquifers at the middle and south of the desert are connected to the deep aquifer, thus providing a good potential for groundwater development. In the Moghra aquifer, the groundwater flow is in general directed towards the Qattara Depression. The aquifer is recharged by rainfall and lateral direct inflow from the Nile aquifer. Due to the sharp increase in abstractions for groundwater-based reclamation projects in the Egyptian Western Desert and industrial and municipal supply, notably in the Western fringes of the Nile Delta, the water quality and sustainability of this resource is at risk. The Coastal aquifers exist near the western northern coast of Egypt and are recharged by rainfall on the western coast. Quantities that can be abstracted are limited due to the presence of saline water underneath the fresh water layers.

2.2 Water Demand

Various demands for freshwater are exerting excessive pressure on the available water supply. The agricultural sector (including fisheries) is the highest freshwater consumer, utilizing about 86% of the available supplies (excluding recycling), while the domestic and industrial sectors consume 6% and 8% of the total natural supplies. The navigation and energy (i.e. hydropower) sub-sectors are “instream” users; meaning that they utilize the Nile/irrigation distribution system, but they are not net consumers of the water resources. Drainage water spilled to the Mediterranean Sea and the desert fringes of the Nile system contributes the water needed to maintain the ecosystem/habitats of the northern Delta/Lakes. Evaporation losses from the 31,000 Km-long water conveyance network is estimated at about 2.4 BCM/yr. Water resources management, hydraulic control, channel design, distribution networks, and water discharge monitoring has been practiced by Egyptians for over 5000 years. The total dam

capacity is about 169 km³ mainly attributed to the reservoir of the Aswan high dam. About 90% of the Nile's hydro-potential has been exploited to generate about 12 Twh. The irrigation potential is estimated as 4.4 million ha. Agricultural drainage through primitive pumping stations and excavation of main drains has been practiced in Egypt as early as 1898. Ditch drainage has been introduced in 1938 followed by sub-surface drainage in 1942. The Egyptian Public Authority of Drainage Projects (EPADP) has launched a comprehensive drainage construction/rehabilitation program in Egypt that covers 8.0 Million feddan of agriculture lands since late seventies. EPADP has been either constructing new surface (open) drains or rehabilitating (remodeling, deepening, widening, and weed removal) existing open drains. EPADP accomplished 7.2 Million feddan with surface open drainage till end of 2004. Parallel with that, EPADP introduced a long-term planning for flexible construction of subsurface drainage in an area of 6.4 million feddan, which widely enabled the use of mechanized pipe-laying, plastic pipes and synthetic envelope materials by public and private contractors. EPADP accomplished 5.4 Million feddan of subsurface drainage till end of 2004.

The first and most important challenge in Egypt is satisfying the future water demand corresponding to the expected population growth. The population of Egypt has been growing in the last 25 years from about 40 million in the year 1978 to about 72 million in 2004 and is expected to reach somewhere between 85 - 95 millions in the year 2020 according to different scenarios. More than ninety five percent of the present population of Egypt is concentrated in only about 5.5% of the total area namely in the Nile Valley and the Delta. The government has started an ambitious program to increase the inhabited area in Egypt from the present 5.5% to about 25%. Water demand is rapidly increasing due to the growing population and hence a growing demand for water by agriculture, horizontal expansion in the desert areas, industrial growth, new communities expansions etc. This triggers more efficient use of present resources and, if possible, to develop additional water resources.

Drinking water requirements for major urban towns and rural villages have been estimated to be 4.6 BCM in 99/2000 where approximately 97% of urban population and 70% of rural population of Egypt relies on piped water supply. The major cities in Egypt (217 city) enjoy full potable water coverage (100%). Sanitation services, however, lag behind water supply, where approximately 52% of urban population is covered by collection and treatment sanitation systems while about 11% of rural population in villages is connected to the sewerage system. Municipal water is diverted from two sources: surface water which supplies about 83% of total municipal demand and groundwater, which supplies about 17% of total demands. The total municipal demand (drinking water) is calculated to increase by a factor of 1.4 between 2000 and 2017. The total industrial water utilization is expected to increase by a factor of 2.0 throughout the former period.

Fisheries rely greatly on water resources and are directly affected by water allocation policies. The total fish production in Egypt reaches 725 thousand tons in the year 2002 where 18% of it came from marine fisheries. A population of about 700,000 fishermen earns their living from inland fisheries and related activities. It is estimated that a minimum of 8.5 BCM/yr of fresh and drainage water is required to sustain the present ecological conditions including fish production from the Delta lakes.

With GOE implementing aggressive irrigated agricultural area expansion, water availability per Feddan will vary. The irrigated areas are projected to increase from 7.985 million feddans in 1997 to 11.026 million feddans in 2017 (NWRP).

2.3 Water Quality

In general, surface water quality exhibits deterioration as we move downstream with the worst pollution occurring at the northern lakes. The domestic water demands result into about 3.8 BCM/yr of waste water being discharged into the Nile, out of which 35% are treated. Pathogenic pollution of surface water has been recorded to increase during the 1980s and to decrease gradually throughout the 1990s and in all cases it exists in restricted localized areas. The government comprehensive plans to extend sanitation coverage and waste water treatment to rural areas are expected to eliminate significant pathogenic pollution by year 2017. Industrial effluents contribute to about 1.3 BCM/yr of untreated waste water being discharged to surface waters. Food industries contribute to 45% of total effluent discharge and to 67% of the total BOD load introduced. BOD levels in the Nile, at mid stream, are still below 6 mg/l. The Nile branches experience more Oxygen depletion which may reach a Dissolved Oxygen value of 3 at downstream end presenting potential hazard to aquatic organisms. Industrial effluents contribute to the increased levels of trace elements especially after the construction of the high dam where the potential for flushing the contaminated sediments during the flood period was eliminated. Drainage return flow to the Nile result into an increase in salinity of the water from 130 mg/l at Aswan (far upstream) to 250 mg/l near the delta barrage. Nitrogen fertilizers whose consumption has doubled between 1980 and 1993 present another source of pollution. Water hyacinth flourishing at the downstream of water ways due to increased nutrients lead to clogging of canals and is combated with mechanical and biological technologies. Despite of the flourishing fish production in Egypt, only 17 species remain as of 1995 out of 47 species which used to be available in 1948. A national water quality monitoring program is launched comprising more than 300 observation sites.

2.4 Institutional Framework

Several ministries are involved in managing the water sector. The Ministry of Water Resources and Irrigation (MWRI) plays a key-role in the development and management of the water system in the country. The ministry is in charge of development, distribution and management of water resources, and development and O&M of the associated water works. The Ministry is also responsible for collection and disposal of agricultural drainage water, monitoring and assessment of water quality of the various water sources, and protecting the coastal lakes and the shoreline. The Ministry of Agriculture and Land Reclamation (MALR) is involved in improving agricultural activities and land reclamation, including water management at the on-farm level. The Ministry of Housing, Utilities and New Communities (MHUNC), provides water supply and sanitation services to the municipal and industrial subsectors. Some other ministries participate by different degrees in auxiliary management and operation of part of the irrigation and drainage systems such as Ministry of Health and Population (MoHP), the Ministry of State for Environmental Affairs, and the Ministry of Local Development (MoLD).

Organizational Structure of MWRI

Regarding the organizational and institutional structure of The Ministry of Water Resources and Irrigation (MWRI), there are two major departments and four main authorities that are responsible for the day-to-day operation of the water resources system, irrigation water delivery, and drainage water disposal. Each of these entities has a wide coverage along the Nile

irrigation network and there are several entities within each administrative governorate that carries out all activities related to water distribution and drainage. The two major departments of the MWRI are the Irrigation Department (ID) and the Mechanical and Electrical Department (MED) and they have the widest spatial coverage through their representing bodies as the irrigation directorates, inspectorates, and districts. The organizational structure of MWRI is shown in Figure 2.

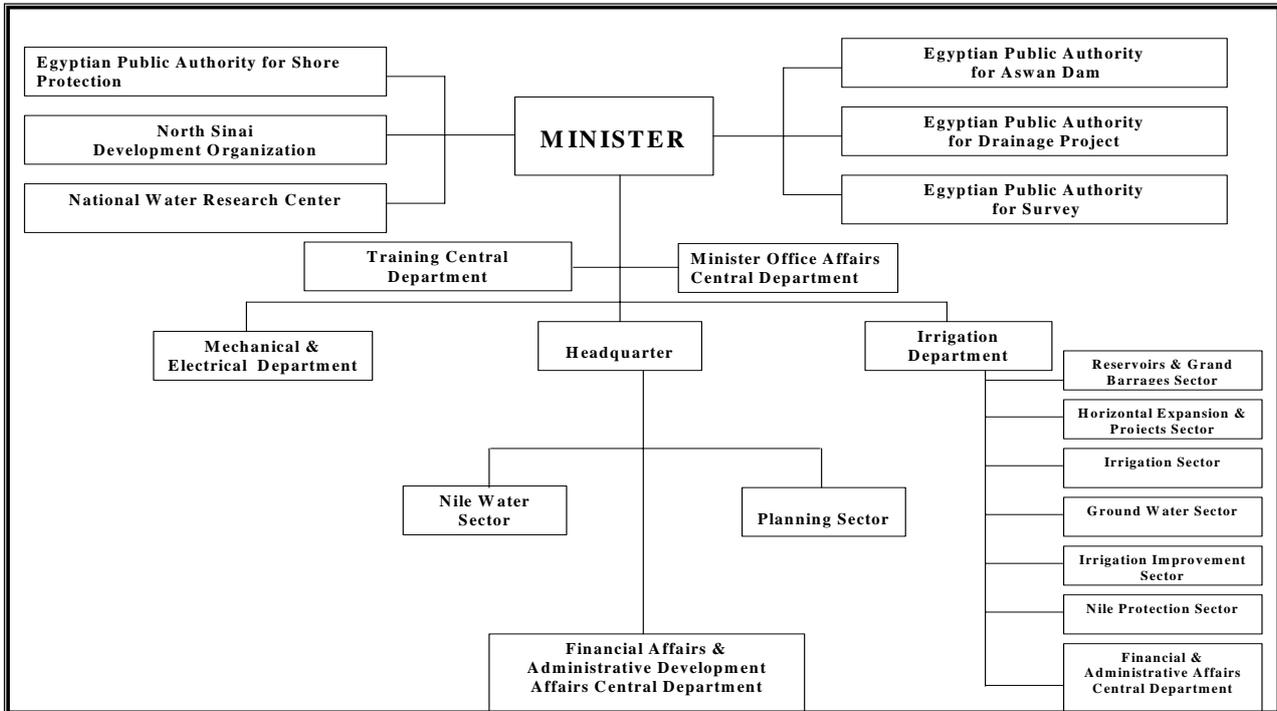


Figure 2. The Organizational Structure of the MWRI

The four main authorities are: the Egyptian Public Authority for Drainage Projects (EPADP), which is in charge of all drainage activities within MWRI, and has representing directorates within the network, the Egyptian Survey Authority, the Coastal Protection Authority, and the High Aswan Dam Authority. The National Water Research Center (NWRN) is the research arm of the MWRI. It consists of 12 research institutes, a Central Laboratory for Environment Quality Monitoring (CLEQM) and the Strategic Research Unit (SRU). Further description of MWRI is presented in Chapter 3.

Ministry of Housing, Utilities and New Communities (MHUNC)

Under MHUNC, the National Organization for Potable Water and Sanitary Drainage (NOPWASD), and its affiliated agencies, are responsible for planning, design and (oversight of) construction of municipal drinking water purification plants, distribution systems, sewage collection systems, and municipal wastewater treatment plants all over Egypt. NOPWASD is responsible outside of Cairo, Alexandria, and the Suez-canal cities. For Cairo, Alexandria, and the Suez canal area, the onus is respectively on the General Organization for Sanitary Drainage in Cairo (GOSDC), the General Organization for Greater Cairo Water Supply (GOGCWS), the Alexandria General Organization for Sanitary Drainage (AGOSD), the Alexandria Water General Authority (AWGA), the Suez Canal Authority.

Operational and Maintenance responsibilities are delegated to the local governments who oversee local agencies. The latter are classified into economic/general authorities and public/private companies or utilities in 9 Governorates (with private companies for wastewater treatment in Damietta, Kafr El Sheikh, Beheira). The General Authority for Potable Water and Sanitary Drainage (GAPWSD) is the central body subsuming these governorate entities. The presidential decree, 135 for 2004, authorizes the creation of a Holding Company for Drinking Water and Sanitation and its affiliated companies that include the General Economic Authorities for Drinking Water and Sanitation operating in the Governorates. The company will seek new financial resources to sustain the O&M budget and relief the burden on the government. Moreover, Presidential Decree, 136 for 2004, covers the creation of the *Central Authority for the Drinking Water and Sanitation Sector, and Protection of the Consumer*. This decree aims at regulation and monitoring, for quality control and consumer-price control. It reports to the Minister of Housing, Utilities and Urban Communities, and will be the liaison body between the government, the society and the holding company to ensure that national policies and regulations are followed by the holding company. The Minister of Housing heads the Governing Board, which includes members from outside the subsector, namely two technical experts and a representative of the consumers, seconded by the Minister of Housing. The Ministries of Finance, Health and Population and of the Environment are represented on the governing board. NOPWASD will act as a technical advisor.

2.5 Legislative framework

Several laws and decrees have been approved by the Egyptian Parliament, the Cabinet of Ministers and the President to organize the work of the MWRI and to organize the distribution of water among different users and recently to protect the environment and water system from pollution. The main laws of relevance to the water sector legislative framework are: Law 12 for the year 1984 for the Irrigation and Drainage, Law 213 for the year 1994 for farmer participation and cost sharing, Law 93 for the year 1962 for the discharge to open streams and its modifications for the years 1962, 1982, and 1989, The law 27 for the year 1978 for Regulation of water resources and Treatment of Wastewater, The law 48 for the year 1982 Regarding the Protection of the River Nile and Waterways from Pollution, The Decree 380 for the year 1982 for the Industrial Water Pollution Control, law of Local Administration no. 43 of 1979, and The Law 4 for the year 1994 for the Environment protection. The NWRP includes a detailed description of all water-related legislation and their current status.

2.6 Financing the Water Sector

Present and future policies are likely to seek primary financing of the water sector only through three principal sources:

- Sovereign sources and general-tax system,
- Agricultural user-fees, and
- Municipal/industrial user-fees.

Currently, the pertinent agencies entrusted with the financing of the public expenditures are the Ministry of Finance; the Ministry of Water Resources and Irrigation (MWRI); the Ministry of Housing, Utilities and New Communities MHUNC); and to a limited extent, the Ministry of Agriculture and Land Reclamation (MALR), mandated to improve on-farm water management and fisheries). These are affiliated to the two major water subsectors: the irrigated agriculture subsector and the water supply and sanitation (WS&S) subsector.

Almost 90% of the development, operation and maintenance (O&M)² costs of water services in Egypt are funded by public sources. The public financing of O&M in the irrigation sector amounts to about 4% of the total public recurrent expenditures. On the investment side, since 2000 some 12 Billion LE of public finance were spent on national irrigation infrastructure and water-resources related programs, which on average-annual would translate to 15% of the average-annual public investments since 2000. Currently, cost sharing for irrigation services is mainly attributed to the land property taxes levied at 30 LE/feddan/year on average, which accrue to the local governments. The land property taxes amount to a total of only 20% of the recurrent budget appropriations channeled by MoF to MWRI.

An on-going Public Expenditure Review study, conducted by the World Bank (2005), depicts that the country's total public spending on new investments is much less than the total recurrent spending (ratio is 20% on average since FY01), yet this pattern is reversed for the water sector. For the water sector the ratio of investment-to-recurrent spending has been ranging from 200% to 300% since FY01. There is generally a declining trend in recurrent expenditures and debt repayment, while investment expenditures are relatively more steady. This suggests that new investments are prioritized at the expense of maintaining existing assets and repaying debts. Figure 3 illustrates water sector public expenditures in Egypt.

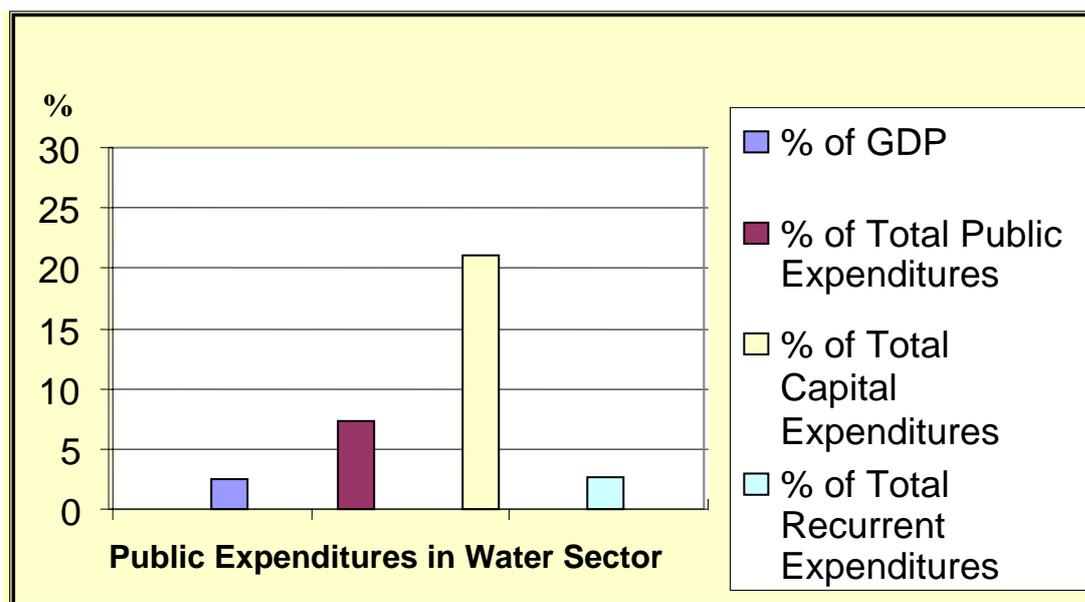


Figure 3. Water Sector Public Expenditures in Egypt (PER – WB 2005)

The entire budget of MWRI is mainly allocated for the administration of irrigation and drainage networks in Egypt that serves all water-use sectors. The irrigated agriculture sub-

² O&M costs pertains to the following items in the budget Chapters of the water related Ministries:

- Partly Chapter 1: wages that relates to O&M, as apposed to tasks of planning and other central administrations
- Chapter 2: goods and services for O&M, and
- Partly Chapter 3: as concerns only the regular/preventative rehabilitation investments (as opposed to occasional/major rehabilitation investments).

sector consumes about 85% of the budget of MWRI while 10% are devoted to services for the water supply and sanitation sector subsector, and 5 % attributed to the industrial sector. The latter distribution is based on sub-sectoral water usage ratio. The ministry of Agriculture and Land Reclamation (MALR) contributes to the water sector by about 20% of the annual budget of its administrative agency and service authorities in addition to 50% of the annual budget of the General Authority for Reconstruction Projects and Agriculture Development (GARPAD).

Municipal Water Supply and Sanitation

The municipal water supply and sanitary services are carried out by a set of economic authorities affiliated with the Ministry of Housing, Urbanization and New Communities (MHUNC) and to a less extent through the Ministry of Local Development (MoLD). The analysis of the budgets of these economic authorities of MHUNC showed that the total annual budget allocated for these authorities increased from L.E. 4.73 billion in year 1997/98 to L.E. 8.45 billion in 2003/04. During the period 1982 – 2004, a total of 25.0 billion L.E. worth of investments have been channeled by the state budget to potable water supply services. Moreover, a total of 40 billion L.E. have been invested in sanitation services. The potable water productive increased from 5.8 million m³/day in 1982 to 18.2 million m³/day by year 2000. The per-capita rate of potable water use increased from 130 liter/day in 1981 to 275 liter/day in 2000. Productivity of sanitary stations increased from 1.0 million m³/day in 1982, to 8.3 million m³/day in 2000, and planned to reach 20.0 million m³/day by 2017. As of today, rural sanitation still presents a major challenge and an impeding factor along the track of environmental sustainability.

As for the industrial sector, the private sector is mainly responsible for providing the investments and O&M costs required for water services. The government provides a set of incentives for the industrial sector to comply with environmental regulations.

Sector Financing

An overall view of the financing of the water sector is illustrated in Table 1³ which provides *estimates* for investment costs for water projects and O&M costs as per each stakeholder and each subsector (irrigated agriculture, water supply and sanitation, industrial, in addition to environmental degradation cost estimates). The distribution of total expenditures among the major agencies within the water sector is shown in Figure 4.

The estimated investment costs for water services from the three ministries have increased from 4.31 billion L.E. in year 1997/98 to 7.4 billion L.E. in year 2003/04. While the estimated O&M costs was increased from L.E. 2.0 billion L.E. to 3.38 billion L.E. in the same period.

³ As depicted from the WB study “Integrated Approach to Water Resources Management in Egypt: Financial Sustainability” (2004).

Table 1. Investment and O&M Costs for the Water Sector

<i>All values are in Billion L.E. per Year</i>	Stakeholder (Budget Provision)		Investments in Water Projects		Operation and Maintenance		Total Costs
			97/98	03/04	97/98	03/04	03/04
Irrigated Agriculture Sector	MWRI		1.555	2.771	0.442	0.662	3.433
	MARL		0.275	0.489	0.111	0.165	0.652
	Sub-total		1.830	3.260	0.553	0.827	4.087
Water Supply and Sanitation Sector	MHUNC	Water Supply	0.991	1.65	0.580	1.027	2.677
		Sanitation	1.490	2.480	0.870	1.54	4.020
	Sub-total		2.481	4.130	1.450	2.567	6.697
Industrial Sector	Private Sector		1.140		1.180		2.320
Environmental Degradation	State Budget		Damage cost ~ 1.62 – 3.24% of GDP				

The NWRP predicts a total of 145 billion Egyptian Pounds worth of investments within the water sector during the period 2003 – 2017. The Ministry of Housing, Utilities and New Communities is foreseen to contribute to 63% of the latter investments and the Ministry of Water Resources and Irrigation will provide 32%. The private sector, based on current scenarios, will take care of about 5% of these investments.

The total recurrent costs in the same period 2003-2017 are estimated at BLE 44. These costs include the operation and maintenance costs of the system but exclude the personnel costs of the government agencies. The municipalities (Ministry of Local development) take by far the biggest share of the O&M costs (70%) for the operation and maintenance of the drinking water treatment plants and the waste water treatment plants. The Ministry of Water Resources and Irrigation will cover 12% while the private sector will contribute about 15%.

In summary, the costs for water services for the next fifteen years will be more than triple the current expenditures. Future allocation of such high costs presents a heavy burden for the government state budget. Alternative scenarios for financial sustainability of the water sector need to be addressed

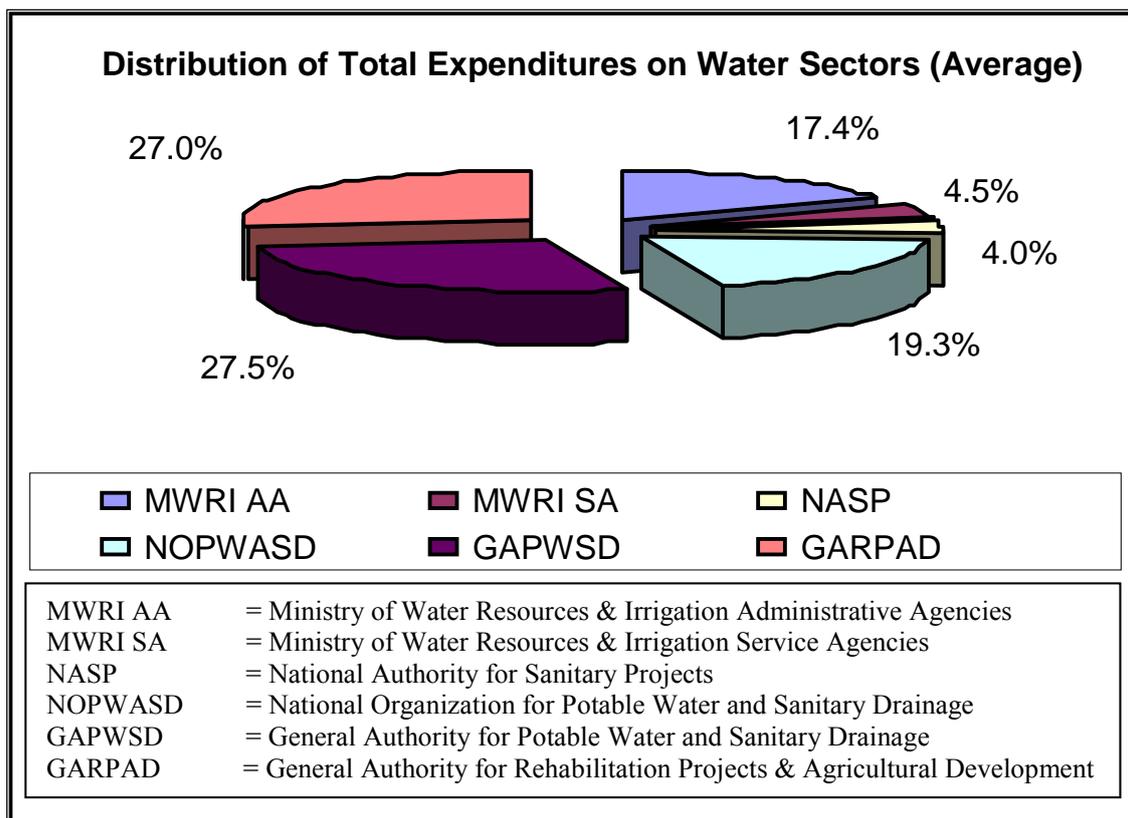


Figure 4. Distribution of Total Expenditures among the Major Agencies Within the Water Sector

Chapter 3

IWRM Implementation: Specific Challenges and Current Responses

This chapter presents the experiences of reform efforts to date. The Chapter summarizes the institutional, regulatory, and stakeholder involvement challenges in the water sector and identifies how the NWRP has combined the efforts of various agencies working with MWRI and the water sector at large to propose reform policies and physical interventions. A summary of the main measures included in NWRP is presented in Annex 5. The Chapter also identifies MWRI's vision for water management in the country over the next two decades. The gaps between vision and current GOE efforts are developed from the diagnosis. The next Chapter identifies the actions agreed upon as major interventions to pursue an effective integrated framework for water management.

3.1 Summary of Overall Challenges Confronting the Government of Egypt

There are numerous challenges facing the Government of Egypt as pertaining to water resources management:

- First, there is an immediate need to adopt and implement a strategy and action plan for achieving food security.
- Second, there is an urgent need to bridge the gap between the escalating demands on freshwater resources as a result of growing population and expansion in industrial / agricultural needs and the limited supply of renewable water resources.
- Third, there is a pressing need to preserve and enhance water quality and safeguard against various sources of pollution.
- Fourth, there is a firm commitment to achieve the millennium development goals (MDG) in relation to water supply and sanitation.

These are significant challenges that need to be addressed. Resorting to integrated approaches for water management is recognized as the most promising alternative. The main focus of this Chapter is to identify the main challenges to practical application of IWRM in Egypt.

3.2 Impediments to IWRM Implementation

Following several recommendations by international and global organizations concerned with water management, the main pillars for IWRM can be categorized into four key elements:

- Treating water as a holistic resource, and hence addressing resource and cross-sectoral issues, including quantity and quality aspects;
- Managing water at the lowest appropriate level (the subsidiarity principle), using appropriate public and private sector instruments, including government agencies, water users, private sector, and local communities (or decentralization of water management);
- Ensuring effective stakeholders participation, and
- Ensuring financial sustainability.

In comprehensively addressing these elements, the challenge in IWRM is to optimally address sector efficiency, equity, and environmental and financial sustainability. As water resources extend across administrative and sector boundaries, there are complex linkages between the efficiency, equity, environmental and financial sustainability implications. In close and direct consultations with MWRI, the following emerged as impediments to IWRM implementation in Egypt:

- The immense size and scope of the water quality/rural sanitation problems and the continuing deterioration of the situation;
- Intensification of inter-sectoral and inter-regional waters allocation problems.
- Inadequacy of government funds for new investments and for operating and maintaining existing infrastructure.
- Poor cost recovery and operational performance for both urban water supply and irrigation/drainage;
- Excessive government involvement in service provision and associated bureaucratic control.
- Legal constraints on stakeholder involvement in O&M and fee collection.

These impediments have been studied as part of MWRI efforts to develop a National Water Resources Plan, and as such solutions have been brought to bear on the problems. In addition, efforts by MWRI include institutional reform, Integrated Water Management Districts, Integrated Irrigation Improvements, Rural Sanitation Framework, Water Boards and others. The NWRP has further combined the challenges from lessons learned to pave the way for solutions. A summary of the challenges is presented below.

The NWRP specifically identifies the following challenges:

1. **Securing water for people.** Quantity is not the problem in increasing the access to safe drinking water. The challenge is to take care that the quality is according to health standards and to provide the necessary facilities such as drinking water plants and distribution systems.
2. **Securing water for food production.** Agriculture is a major economic activity in Egypt. However, agriculture is a major water consumer, it accounts for about 95% of the total net demand in Egypt. Population growth in combination with the horizontal expansion plans of the government will increase the demand for irrigation water.
3. **Securing water for industry, services and employment.** To improve the welfare of the people and given the limitations in the water supply for agriculture, Egypt will have to give priority to the development of other livelihood opportunities than agriculture, in particular the industrial and services sectors. Also in this case the challenge is not quantity but quality and to provide adequate facilities not only for the supply of the water but also with respect to the sewage water that will be produced.
4. **Developing a strong institutional framework.** The concept of IWRM stimulates cooperation between stakeholders, decentralisation and privatisation. This requires a different set-up of the institutional system around water management and co-ordinated policy making, implementation, institutional and professional boundaries. In addition to the existence of sufficient legal and financial means in these institutions.

5. **Creating popular awareness and understanding.** Includes public awareness of the water scarcity and water quality deterioration. This public awareness and subsequent pressure for action may help in stimulating the political will to act.
6. **Protection and restoration of vital ecosystems.** The aquatic ecosystems in Egypt are affected by the deteriorating quality of the water. Coastal lakes should be restored to their original states. The remaining systems are limited in need to be protected.
7. **Co-operation with Nile Basin countries.** Egypt, will be influenced by developments upstream. Co-operation with Nile Basin countries is needed to ensure an equitable development of the Nile Basin as a whole.
8. **Stimulating the political will to act.** Raising the awareness and bringing the water issues to the suitable place in the political agenda is a must for the long-term success of sustainable water resources management. This will lead to ensure political support and the necessary investments to the water sector development in Egypt.

3.3 Future Approaches to Water Resources Planning and Development

The broad outlines and desired future approaches to water management, development and use are listed below:

- Water management is being conducted at the lowest appropriate level.
- The MWRI is transferred from a vertically oriented structure to a more streamlined regulatory institute with utmost decentralization potential. This will be achieved as a consequence of conducting a grass root institutional reform program
- Awareness of IWRM is raised at all levels. Awareness efforts are coordinated and complimentary to each other.
- Effective and efficient stakeholders participation is achieved.
- Water is being treated as a holistic resource
- Smooth and transparent flow on information through appropriate channels
- Communication and coordination between all levels horizontally and vertically is being achieved
- The political will is mobilized to support IWRM initiatives,
- Water quality is fully controlled and monitored
- Water quality issues, plans, and actions are executed at the hydrological basin level
- Agricultural policies and plans are coordinated with irrigation plans.
- Laws of relevance to the water sector are being enforced and environmental compliance is achieved
- Research is directed to solving national problems

In line with desired approaches above, the MWRI Institutional Reform Unit envisages MWRI's future role to be mainly in:

- ✓ Planning of integrated water resources management
- ✓ Implementation of programs and projects
- ✓ Regulation and licensing within the legal framework
- ✓ Monitoring and evaluation (M&E)
- ✓ Design and construction of the main national infrastructure

- ✓ Water resources development and adopting modern technologies for water management
- ✓ Strengthening water demand management
- ✓ Promoting economic incentives for better water utilization, encouraging public private partnerships, and adopting cost recovery policies
- ✓ Achieving environmental sustainability
- ✓ Provision of support for public and private sector and promoting feeling of wider ownership
- ✓ Human resources development.

3.4 Major Stakeholders

MWRI is the leading official government entity mandated to develop and manage the water sector. The Ministry of Agriculture and Land Reclamation (MALR) is involved in improving agricultural activities and land reclamation, including water management at the on-farm level. The water distribution system bifurcates from the Nile river down to main canals, secondary canals, tertiary canals (or so called “mesqas”), and ending with the farm-level irrigation system. The jurisdiction/mandate of the MWRI extend from the Nile river down to the main- and secondary-canal levels, as water assets are publicly/state owned down to the secondary-canal level. The tertiary-canal and on-farm levels are privately owned by farmers. However, the MWRI and MALR are entrusted to help farmers improve water management at the mesqa and on-farm levels respectively. The third major water-related public agency is the Ministry of Housing, Utilities and New Communities (MHUNC), providing water services to the municipal and industrial subsectors.

Other major stakeholders currently involved in the water sector and who will have significant roles in the future, are listed and described below:

- Ministry of Agriculture and Land Reclamation (MALR)
- Ministry of Housing, Public Utilities and New Urban Societies (MHUNC)
- General Organization For Industrialization (GOFI)
- Ministry of Health and Population (MOHP)
- State Ministry for Environmental Affairs (MoSEA)
- River Transportation Authority (RTA)
- Ministry of Local development (MLD)
- Ministry of Electricity and Energy (MOEE)
- Several NGOs working in rationalizing water.
- Water Users Organizations (WUA).

3.4.1 The Ministry of State for Environmental Affairs (MoSEA)

The Minister of State for Environmental Affairs presides the Egyptian Environmental Affairs Agency EEAA, which is the executive entity of MoSEA, and has an advisory task before the cabinet. EEAA has a water quality department. Water quality legislation in Egypt is governed by two main Laws: *Law No. 48/1982 for protection of the river Nile and waterways from pollution;* and *Law 4/1994 on Environmental Protection.* Although EEAA is responsible for the environment countrywide, Law 4/1994 retained most of the enforcing authority for inland waters with MWRI and the Ministry of Interiors. As EEAA is responsible for inspections regarding compliance with environmental and occupational health and safety regulations, it has to manage water quality in coordination with MWRI and the Ministry of Health and Population. EEAA also monitors wastes from inland Nile fleets and coastal waters. In

cooperation with the MWRI it prepared an action plan to reduce Nile water pollution from industrial effluents. Implementing the plan advanced well, as major industries met the Compliance Action Plans (CAP's).

3.4.2 The Ministry of Health and Population (MoHP):

MoHP is in charge of public and environmental health. Thus MoHP has a central role in water quality management, particularly with respect to standard setting for: quality of potable water sources (the Nile, canals, and groundwater); drainage waters that can be mixed with fresh water; industrial and sewage treatment plant discharges; and wastes discharged from river cargo/tourism vessels. Within the framework of Law 48/1982 this Ministry is involved in standard setting and compliance monitoring of wastewater discharges. In case of non-compliance of drinking water quality, especially with respect to bacterial contamination, MoHP takes disciplinary action. In addition to developing standards, the ministry samples and analyzes all industrial, municipal, and wastewater treatment plant effluents.

3.4.3 The Ministry of Industry (MoI)

Within the MoI, and as concerns only the public-industry subsector, the General Organization for Industrialization (GOFI) oversees the firms' activities relating to water use and water pollution control. GOFI however does not perform inspections or verify whether industries are in compliance with license requirements. The General Department of Construction and Environment within the Ministry is in charge of providing TA to industrial firms to help them comply with the Law 48 of 1982. A Ministerial Decree of that Law obligates industrial facilities to install and operate water treatment equipment at points of disposal to the water system. As for disposal to public sewer systems, according to Law 93/1962 and its Amending Decree 9/1989, industrial wastewater must receive pre-treatment. The government is advancing on the process of privatizing the industrial sector, yet to date GOFI is still managing 330 or less industrial facilities. Apart from direct discharges to the Nile, implementation of effluent treatment is generally not enforced as the government owns the majority of the discharging facilities.

3.4.4 Ministry of Local Development (MoLD)

The MoLD co-ordinates all activities of the government's line agencies at the governorate and local-community levels. MoLD identifies the programs needed to improve services at these levels, including drinking water, sanitation, and protection of the environment. The required funds are shared between the Government budget, the local public, the concerned communities, and donors.

3.4.5 The Ministry of Electricity and Energy (MoEE)

The MoEE is responsible for power generation; hence it coordinates with MWRI regarding hydropower generation. The MOEE also operates thermal power plants that draw water from the Nile for cooling purposes. The return flows may cause thermal pollution.

3.4.6 Ministry of Transportation (MoT)

The River Transport Authority (RTA) of the MoT manages navigation activities along the course of the Nile and main canals downstream of the Aswan Dam, in coordination with MWRI. The activities include dredging, as there are navigational bottlenecks at the shallow sections of the Nile and the main canals.

3.4.7 Ministry of Tourism

The Ministry of Tourism requires that MWRI maintain a depth of water in the Nile and main canals as sufficient for commercial and recreational navigation (e.g., floating hotels and tourist vessels) as well as for aesthetic purposes. The same applies for the coastal tourist areas on the North coast and the Red Sea.

3.4.8 Ministry of Interior

In coordination with the aforementioned line agencies, the Ministry of Interior is in charge of enforcing the water-related laws, and collection of fines including those relating to water extraction, pollution or other impacts. The *Surface Water Police* is the responsible enforcement entity.

3.4.9 The Ministry of Agriculture and Land Reclamation

The agriculture sector contributes 18% of the GDP, 12% of the export earning, and employs about 35% of the labor force. The sector's policy until end of the 1970s was characterized by heavy government interventions in production, trade and prices. Since the 1980s the sector has been fostering liberalization and privatization reforms. Without interfering in farmers selection of crop type, and under most farm inputs and outputs priced at market prices, the MALR and its research centers conduct research and extension towards improving farm output per unit of water and land. The MALR also sets land reclamation and horizontal expansion policies, aligned with the water resources plans by the MWRI.

The General Authority for Rehabilitation Projects and Agricultural Development (GARPAD) of the MALR is in charge of the design and implementation of the expansion projects prior to transferring to public sector agricultural companies or private investor. Water management of these new reclaimed lands is however the responsibility of the MWRI.

The Soils, Water and Environmental Research Institute (SWERI) undertakes research and piloting for better soil-water quality management, including better use of fertilizers and pesticides, and it monitors soil and water quality for agricultural uses. As managing water at the on-farm level is more of MALR mandate than MWRI mandate, SWERI has a good track record of coordinating with MWRI. The General Authority of Fish Resources Development (GAFRD) in the MALR is responsible for development of fisheries.

3.4.10 Ministry of Housing, Utilities and New Communities (MHUNC)

The Ministry of Housing Utilities and New Communities (MHUNC) is implementing national programs to expand municipal water treatment capacity and provide adequate sanitation facilities. Municipal water demands are managed by several organizations of the MHUNC: the National Organization for Potable Water and Sanitary Drainage (NOPWASD), the public companies for municipal water and sanitary drainage in both Cairo and Alexandria, and the economical public authorities in 9 Governorates. The regional wastewater authorities and other bodies affiliated that are responsible for both water and wastewater treatment include:

- The General Organization for Sanitary Drainage in Cairo (GOSDC)
- General Organization for Greater Cairo Water Supply (GOGCWS)
- The Alexandria General Organization for Sanitary Drainage (AGOSD)
- The Alexandria Water General Authority (AWGA)
- The Suez Canal Authority
- A number of private companies for wastewater treatment in Damietta, Kafr El Sheikh, Beheira and other Governorates.

NOPWASD sets national plans for drinking water and sanitary drainage works and preparing their execution programs as a prelude towards including them in the state general plan and monitoring their implementation. NOPWASD specifies conditions and standard for sewage and sanitary drainage projects and potable water projects and monitor compliance with these specifications.

NOPWASD has an independent annual budget comprising all investments in potable water and sanitary drainage at the national level excluding those investments appropriations of economic public authorities for drinking water and sanitary drainage. NOPWASD is the official entity for making decisions regarding distribution of investments for large-scale drinking water and sanitary drainage projects in Governorates.

3.4.11 Water Users Associations WUAs, Private Sector and NGOs

There are other stakeholders involved in water services and management:

- *Farmers* (tenants/owners) and farmer organizations, namely WUAs and Water Boards, participate in O&M of the irrigation system at the mesqa and secondary-canal levels.
- *Private sector companies* (contractors, suppliers and Egyptian and International consultancy firms) carries out services via service contracts with the MWRI.
- *Public sector companies, or holding companies*, owned by the Government, but operate as the private sector (e.g., the two holding companies set up for the management of mega projects in Southern Valley & West Delta and in North Sinai, and the WS&S holding company, subsuming 14 subsidiary companies nationwide).
- Several other holding companies owned by the MWRI and MALR for construction of irrigation systems, drilling of groundwater wells, land reclamation, etc., and now being transferred to the ownership of investors and private-sector companies.
- The *NGOs* form an integral part of local communities' development programs in the rural areas (e.g., Shorouq programs overseen by MoLD). Their roles include hygiene promotion and protection of the public health and the environment, improved water supply intakes and sanitation conditions, manual channel maintenance, drinking water saving campaigns, and public awareness.
- *Academic and research institutes* related to water resources management.

3.5 Multi-Sectoral/Multi-disciplinary Coordination

Coordination and communication represent a key element in the integrated water resources management. Coordination among agencies or departments of the same agency will ensure the harmony and integration of actions and interactions of the agencies. Communication facilitates the transmission of information among stakeholders to ensure informed -decisions. In the field of IWRM, three levels of coordination and communication (C&C) are identified:

- Drafting of relevant Policies and setting of strategies
- Planning, and implementation of projects, and other issues handled by middle-level management
- Operational issues

3.5.1 Coordination and Communication (C&C) within MWRI

Following the WB study on the *Holistic Approach to Water Resources Management*, Imam (2004), many committees have been established within the MWRI to facilitate and enhance the C&C activities. Two examples for ongoing efforts include: the “*General Policies*” committee;

and the *Planning Coordination* committee. Additional *project-related committees* have also been formed within the Ministry to steer and coordinate these projects (NWRP, WBP, etc).

The “General Policies” Committee is a permanent internal MWRI committee formed from all the heads of the different sectors of the Ministry in addition to the chair of the NWRC. The committee meets on a regular basis and is responsible for:

- Reviewing and setting the general policies of the MWRI;
- Approving and recommending the required institutional development within the MWRI;
- Discussing and steering the strategic studies in different aspects of the water management;
- Following up on the implementation situation of mega projects in addition to the agreed upon previous decisions. The minutes of the committee meetings are presented to the Minister for approval and comments.

3.5.2 C&C at the Inter-sectoral Level

The inter-sectoral C&C depends mainly on a variety of committees. Committees may be permanent or formed in connection with certain donor-assisted projects or with the execution of major national projects. The decree to form a certain committee usually lists the membership of the committee, specifies the periodicity of its meetings, and its mandate; although not always in sufficient details. Examples of the main committees include:

- Water Planning Committee;
- Nile High Committee;
- Ministerial High Committee for the Implementation of the Mega-Projects;
- The committee on Shore Protection;
- The Committee on Nile Embankment Improvement;
- The Committee on Re-use of Treated Wastewater.

In addition, a numerous project-related committees have also been formed (NWRP, Water Board Project, NAWQAM, IMS, Ground Water Sector Project, EPIQ). Committees carry out their activities through regular meetings, extended workshops and seminars; technical memos and questionnaires. Project-related committees usually terminate after the completion of the project that initiated the committees.

3.5.3 Recommendations to Improve C & C

Two main recommendations are proposed through the Holistic Approach to Water Resources Management Study (2004), to increase the effectiveness of the C & C:

- Establish a higher committee for water resources management to facilitate the coordination and implementation of strategies and plans pertaining to the water sector at the national level ; and
- Expanding the role of the technical committee for the national water resources plan to supervise further planning and implementation activities within the MWRI and to coordinate efforts with other stakeholders within the water sector.

Furthermore, restructuring of the present committees may also be considered. The MWRI is currently considering several alternatives to improve C&C.

3.6 Ongoing Efforts by MWRI

The following is a listing of examples of the major ongoing efforts undertaken by MWRI towards achieving integrated water resources management

3.6.1 Water Resources Management Policy 2000 - 2017

The main features of the water policy of Egypt to the year 2017 can be summarized as follows (MWRI, 2000):

- 1 Promoting decentralization within the MWRI
- 2 Conducting institutional reform activities at all levels
- 3 Enhancing water supply and management:
Developing new water resources through:
 - Nile River water supply can be increased in the future through cooperative projects with Nile riparian countries.
 - Rainfall and flash flood harvesting is estimated at about 1.0 BCM.
 - Drainage water reuse can be increased from 4.7 to 9.0 BCM by the year 2017.
 - Deep groundwater extraction can be increased from 0.57 to 3.50 BCM till the year 2017.
 - Shallow groundwater extraction in the Valley and the Delta can be increased from 4.80 to 7.50 BCM by the year 2017.
 - Reuse of treated wastewater can be increased from 0.70 to 2.00 BCM till the year 2017.
 - Desalination of sea water can be increased according to needs.
- 4 Improving the efficiency of the present use of water resources through:
 - Minimize water losses from water surface in canals, drains & irrigated areas.
 - Irrigation Improvement projects (IIP) in 3.50 Million feddans can save 4.0 BCM by the year 2017.
 - Setup a fair cost sharing system for all related operational and maintenance activities for water infrastructures.
 - Cropping pattern shifts to save about 3.0 BCM of water.
 - Increase of efficiency of Municipal water use.
- 5 Emphasizing the water quality management in industrial, domestic and agricultural sectors.
- 6 Implementing environmental management systems for the Northern Lakes
- 7 Achieving better integration between agricultural policies and irrigation policies
- 8 Promoting the ethics for water use.
- 9 Continual cooperation with Nile riparians.

The current policy depends on the following success factors and instruments for the policy achievements:

- Public awareness
- Capacity building for all levels of stakeholders
- Continuous monitoring and evaluation.
- Water quality monitoring programs.
- Drainage water quality monitoring programs.
- Groundwater quality monitoring programs.
- Improvement of water resources management systems through:
 - Users' participation in water management.
 - Institutional strengthening of MWRI.
 - Co-ordination between MWRI and other ministries.
 - Continual revision and of laws and decrees pertaining to the water sector and adoption of effective enforcement mechanisms.
 - Transboundary cooperation through implementation of the Nile Basin Initiative programs.
 - Use of modern technologies in water resources management.

3.6.2 National Water Resources Plan (NWRP)

The main objective of the NWRP project is: "To develop the National Water Resources Plan (NWRP), that describes how Egypt will safeguard its water resources in the future, both with respect to quantity and quality, and how it will use these resources in the best way from a socio-economic and environmental point of view". The planning horizon is the year 2017. The project is hosted in the Planning Sector of the MWRI.

This plan tries to achieve the national objectives related to the water sector by developing new water resources, improving the efficiency of the present use and to protect environment and health by preventing pollution and by treatment and control of polluted water. Many of these activities are carried out in co-operation with other ministries such as the Ministry of Agriculture and Land Reclamation, the Ministry of Housing, Utilities and New Communities, the Ministry of Health and Population and the Ministry of Environment.

The National Water Resources Plan has the economic and social development objectives to increase employment, improve equity in water distribution and farmers income, and attain some minimum level of food self-sufficiency. The plan has the additional objectives of meeting water needs in all sectors in the future, protecting public health and the environment, the recovery of operational and maintenance costs to enable better services, and the institutional strengthening. The NWRP project has also endeavored to create the necessary co-ordination mechanisms to develop consensus on the objectives and implementation of the NWRP between all stakeholders involved. It also aims to develop the capacity to monitor and evaluate the implementation of the Water Sector programs and provides inputs for the water component of the National Investments Plans.

Implementing the NWRP strategy 'Facing the Challenge', as stated in the NWRP, is expected to improve the performance of the water resources system. More water will be available for the various uses and the water quality will improve significantly. The agricultural area will increase by 35% as a result of horizontal expansion and the two mega projects in Toshka and the Sinai. Living space in the desert will be created for more than 20% of the population as a result of these projects. The implementation of the strategy will support the socio-economic development of the country and provide safe drinking water to its population. The access of the

population to safe sanitation facilities will double from the present 30% to 60%. Summarizing and as stated in the objectives, the strategy will safeguard the water supply up to the year 2017.

However, at the same time it should be realized that by implementing all these measures, in particular all the planned horizontal expansion projects, the water resources system has reached its limits of what it can support.

3.6.3 Water Resources Supply Management Vision for 2050

Looking to the future, the Ministry of Water Resources and Irrigation, through its National Water Research Center and other sectors, has developed a future vision for the year 2050. This vision is set to safeguard Egypt's demand from currently available water resources which include Egypt's share of the Nile Water, as well as the groundwater, and the non-conventional resources. A primary focus is attributed to increasing sea water desalination for drinking water purposes in the coastal areas, increasing the efficiency of water conveyance systems and water use, and implementing water reuse programs without relying on the additional increase of Egypt's share of the Nile Water.

The principles of the vision include:

- Providing clean drinking water for 100 % of the population.
- Providing adequate water both in quality and quantity for different development purposes; such as agricultural, industrial, navigational, tourism purposes and etc...
- Maximize the economic, social and environmental role of water resources.

3.6.3.1 The main pillars of the vision

- Making the best agricultural, social and environmental use of the available water resources by means of irrigation improvement and changing crop patterns
- Applying Integrated Water Resources Management approach through developing governmental and non-governmental Institutions as well as enforcement of laws and legislations
- Allocating different conventional and non-conventional water resources (agricultural drainage and wastewater reuse, sea water and brackish water desalination, rain harvesting, flash flood harvesting)
- Cooperation with the Nile Basin countries
- Supporting and enhancing the private sector role in water management
- Pollution abatement as well as preserving water resources

This could be accomplished through cooperation with various stakeholders and institutional reform by means of merging different sectors as well as purging incompetent ones to cope with the potential changes.

3.6.4 Institutional Reform Vision

Following the analysis presented in section 3.3, the Institutional Reform Unit (IRU) of the MWRI is compiling and developing an institutional reform vision through proper consultation with various stakeholders within and outside the MWRI. This vision is aiming at decentralizing

decision-making, transferring Operation and Maintenance (O&M) to water users organizations and the private sector and encouraging stakeholder involvement. The MWRI will maintain a more regulatory and supervising role with more emphasis on policy making and planning of IWRM. Also, the MWRI's tasks include defining monitoring and evaluation, and to assure water security and allocations through the main infrastructure

3.6.5 Decision Support System for water Resources Planning based on an Environmental Balance (Environmental DSS project, (1998-2001)

This project has been undertaken by the Strategic Research Studies Unit of the NWRC. The main objective is to develop a methodological approach to sustainable water resources planning. The project aims also at the following objectives: Assist the MWRI and EEAA to draw sustainable policies by proposing a methodology for the integration of environmental and socio-economic aspects in the analysis of water resources scenarios; Develop an integrated, open architecture computer based tool (DSS) to implement the above-mentioned methodology; Develop a set of procedures, rules and relationships to facilitate exchange of information among different organizations; Apply the methodology/DSS in a representative case study; and contribute to capacity building of high level staff of NWRC, Planning Sector and EEAA.

3.6.6 National Water Quality and Availability Management (NAWQAM, 1997-2007)

The NAWQAM Project has four main components:

- 1 The National Water Quality Monitoring component;
- 2 The Water Availability Management component;
- 3 The Drainage Water Reuse and Pilot Schemes component; and
- 4 The Information and Communication Management component.

Component (1) aims at rationalizing water quality monitoring activities into a national program and strengthening the NWRC monitoring and institutional capacity in the field of water quality. The second component develops a database for the MWRI that includes information and data to improve the existing demand forecasting models in the Planning Sector. Component (3) deals with the reuse of drainage water to increase the amount of water available for irrigation mainly in the northeastern part of the Nile Delta along El-Salam Canal. The Information and Communication Management component establishes a broad communication system referred to as a Wide Area Network (WAN) that will be capable of transferring data to and from the NWRC Institutes and MWRI.

The National Water Availability Management Component (2) as implemented by the Planning Sector of the MWRI carries out an assignment to design and implement an Integrated Management Information System (IMIS) that includes all data required by planning sector to fulfill its mandates and functions. The IMIS consists of (National Database, GIS System, Dissemination System, mathematical models). The Database is intended to be the core for formulation of an integrated Computational Framework (CF) for the water resources planning using the existing modeling tools in the planning sector.

IMIS Objectives are: (1) Standardizing Ministry activities and establishing the core of Ministry data warehouse, with strong emphasis on water supply and water demand issues; (2) Establishing a unified coding system and data dictionary that will help in automating information flows between various departments; (3) Building the infrastructure and techniques

necessary for developing a Generalized Decision Support System for the Planning Sector. The system also helps the decision makers to create and test the policies alternatives.

The main advantage of this IMIS is the flexibility of applying different mathematical models at different geographical units. System outputs could be reports, maps, policies and plans. The system includes all items of the integrated water resources management approach, supply side (surface water, ground water, reuse, rain fall, flash flood and desalination) as well as all demand side (agriculture, municipal, industrial, fish farming and livestock ,recreation and environmental needs). Other items such as water quality and economic aspects are also considered.

3.6.7 Water Resources Result Package, Environmental Policy and Institutional Strengthening Indefinite Quantity Contract (EPIQ – WRRP)

The EPIQ–WRRP project is directed towards increasing the global efficiency and productivity of Egypt's Nile water system. The project also aims to: i) To increase knowledge and capacity to analyze and formulate strategies, policies and plans related to integrated water supply augmentation, conservation and utilization and the protection of Nile water quality; ii) To improve water allocation and distribution management policies for conservation of water while maintaining farm income; iii) To recover capital costs of mesqa improvement and to establish a policy for the recovery of operation and maintenance costs of the main system; iv) To increase users involvement in system operation and management; v) To introduce a de-centralized planning and decision making process at the irrigation district level.

3.6.8 Groundwater Resources in Egypt (GWS Project 1999-2004)

The Ground Water Sector (GWS) Project formulates and implements a “general policy” for developing and managing the groundwater and related water resources (flash floods, rainwater harvesting and desalinated water) on the national, regional and sub-regional level. The project supports the GWS through the development of: i) Strategic groundwater plans on national and regional level; ii) Policy implementation plans and monitoring plans on national and regional level; and iii) An organizational structure and capacity building measures.

3.7 Existing Gaps in Moving Towards an IWRM Approach

The following issues are felt necessary to complement the current national efforts (mainly NWRP) in transitioning towards IWRM best practices:

- Refraining, as much as possible, from business as usual scenarios and measures.
- The local and regional dimensions should be emphasized in the proposed actions.
- Issues and actions should be prioritized. It is recommended to focus, primarily, on a subset of priority actions which can initiate the cycle of reform in water management.
- A clear vision for the most appropriate institutional setup has to be settled.
- Mechanisms for stakeholder consultation should be established and reflected into concrete actions.
- Capacity should be assessed and promoted through tangible activities and programs.
- The most appropriate cost/sharing, cost/recovery mechanisms within each sector have to be decided along with a framework for implementation.
- Cost for services has to be identified accurately considering alternative technologies, material, and methods.

- Legal amendments which empower selected entities (Water Boards for example) to collect fees and conduct local action plans should be established.
- Financial models and frameworks to encourage private sector participation should be formulated.

Chapter 4

The Transitional Plan: Advancing Current Trends and Practices Towards an Integrated Management System

This chapter describes in detail the recommended actions and interventions which constitute the transitional plan: Towards Streamlining the Current Trends and Practices into an Integrated Water Resources Management System. It has to be noted that these actions have been concluded after a rigorous diagnosis of the various issues and factors influencing the water sector in Egypt, and following a comprehensive consultation process. The Chapter concludes by listing a number of elements to operationalize the plan in the short, medium, and long terms.

4.1 Description of Interventions

Thirty Nine (39) actions are proposed to fulfill the transition towards integrated water resources management in Egypt. The actions are prioritized and scheduled according to short, medium and long term implementation. The Short Term (ST) time frame comprises three years beginning 2005. The Medium Term (MT) actions are implemented between the years 2008 – 2013, while Long Term (LT) implementation extends for seven years 2013 - 2020. The actions fall under 11 major categories as shown below:

- I. Institutional Reform and Strengthening**
- II. Policies and Legislations**
- III. Physical Interventions**
- IV. Capacity Building**
- V. Technological and Information Systems**
- VI. Water Quality**
- VII. Economic and Financial Framework**
- VIII. Research**
- IX. Raising Awareness for IWRM**
- X. Monitoring and Evaluation**
- XI. Trans-boundary Cooperation**

A presentation of each of these categories (and associated subcategories) follows along with a description of the actions involved. A summary table follows each action and includes a timeframe for achievement of the action. At the end of the Chapter, Table 3 presents the IWRM Action Matrix and the proposed timeline for achievement of activities.

I. Institutional Reform and Strengthening

Institutional fragmentation and lack of interactive participation and coordination between the various key stakeholders in the water sector have been identified as major impeding factors for sustainable development within the sector. Institutional reform, reorientation and

strengthening is thus conceived to be the foundation and basic building block for integrated water resources management.

Actions 1 through 10

Institutional reforms within MWRI are coordinated by the Institutional Reform Unit (IRU) which has been established in 2002. Institutional reform perceptions are mainly aiming at achieving a phased-implementation administrative decentralization of the MWRI hierarchy, establishing participatory water user organizations at different levels, and increasing financial decentralization and cost recovery for O&M for old lands, and full cost recovery for new lands. Institutional reforms will be directed towards creating an integrated legal, organizational, and financial framework for water resource management through establishing basin water management organizations. The imperative added value to this approach is to perform integration of management at the level of the hydrological units which will define the basin boundaries and will as much as possible encompass irrigation and drainage basin layouts. Moreover, the proposed institutional reforms will seek to increase the accountability and efficiency of water service providers, and will seek to accomplish more crop value per drop.

A proposed organizational structure for the irrigation sub-sector may follow the combined functional administration and hydrologic characteristics of the irrigation and drainage networks. It is categorized by four levels, distributed between the Ministry of Water Resources and Irrigation and the Civil Society. In the short and medium terms, the institutional setup is envisioned as follows:

1. National/Central Level :

- a. Ministerial: The **Central Management of MWRI** will mainly include the following sectors: Water Management, Operation and Maintenance (MOM), Planning, Projects and Administration.
- b. Civil Society: A **National Participatory Platform** coordinated through NGOs or Water Partnerships may set the stage for interactive public and civic participation on the long term.

2. General Directorates Level:

- a. Ministerial: Integrated Water Management **General Directorates (IWMGD)** including the following directorates: Water Management, Maintenance and Rehabilitations, Planning and Administration.
- b. Civil Society: **Federation (or Union) of Water Boards (FWBs) coordinating the civic participation at the level of each general directorate.**

3. Districts Level:

- a. Ministerial: **Integrated Water Management Districts (IWMD)** including the following sections: Water Management, Operation and Maintenance, Planning and Follow-up, Legal and Administration.

- b. Civil Society: **District Water Boards (DWBs) for coordination, administration, and follow up on local level civil society organizations**

4. Local Level:

- a. Ministerial: Advisory services only
- b. Civil Society:
 - i. Branch Canal sub-level: **Branch Canal Water Users Association (BCWUAs)**
 - ii. On-farm sub-level: **Water Users Association at Meska level (WUAs).**

The short and medium term setup is depicted schematically in Figure 5. Each Association or Water Board at any level will be formed or will have representatives from the lower level. Irrigation Management Transfer operation to Civil Society will be partial or full based on the capability of each organization and will be conducted according to a phased implementation plan complemented by an intensive capacity building program.

In the medium to long term a National Water Council is foreseen to supervise all activities within the water sector in an integrated manner. The Council will be headed by the Minister of Water Resources and Irrigation (or the Prime Minister) and will include Ministers of all Governmental Stakeholders (Coordinate Ministries) in the Water Sector. The council, when appropriately set, is believed to resolve numerous inter-ministerial and cross sectoral conflicts and will ensure integrated planning, and management of water resources. Another alternative will be to activate the existing Ministerial Planning Coordination Committee and expand its scope and mandate to formulate a high level coordination mechanism to assure good governance within the water sector.

Also, in the medium to long term, Regional Water Management Administrations (RWMAs) are considered and will comprise a board of directors which will include representatives of several ministries and public authorities and local government and would be chaired by a high-ranking MWRI official. RWMAs are required to keep financial accounts, though they are not required to be financially autonomous and they can receive grants from the State Budget. Ideally, EEAA would delegate relevant environmental code enforcement responsibilities to the RWMAs.

In the long term, and after evaluating the performance of the proposed institutional measures, Basin or Regional Water Councils may be established. Also Main Canal Management transfer may be viable to occur depending upon the readiness of the prevailing setup. It is likely that some of the existing directorates (and districts) will have to be reassembled to reflect basin boundaries. Thus, for the short and medium terms the following is foreseen:

Decentralization. The proposed structure fulfils the decentralization principles as it replicates the IWMD model at General/Directorate level. The MWRI National level would have virtually no operational responsibilities apart from O&M and development of the main national water system.

Participation. Within the framework of the proposed model, users are involved at all the operational levels of the structure, including the Water User's Associations at Tertiary Level, Branch Canal Water Boards at Branch Canal Level, District Water Board at District Level, and the federation of Water Boards at the General Directorate Level. The participation is based on

partial or full Irrigation Management Transfer operation according to the capability of each organization.

Basin Integration. Neither the District nor the General Directorate typically represents fully hydrologic unit. At the District and General Directorate levels some adjustments of boundaries may improve the fit of administrative boundaries with hydrological features.

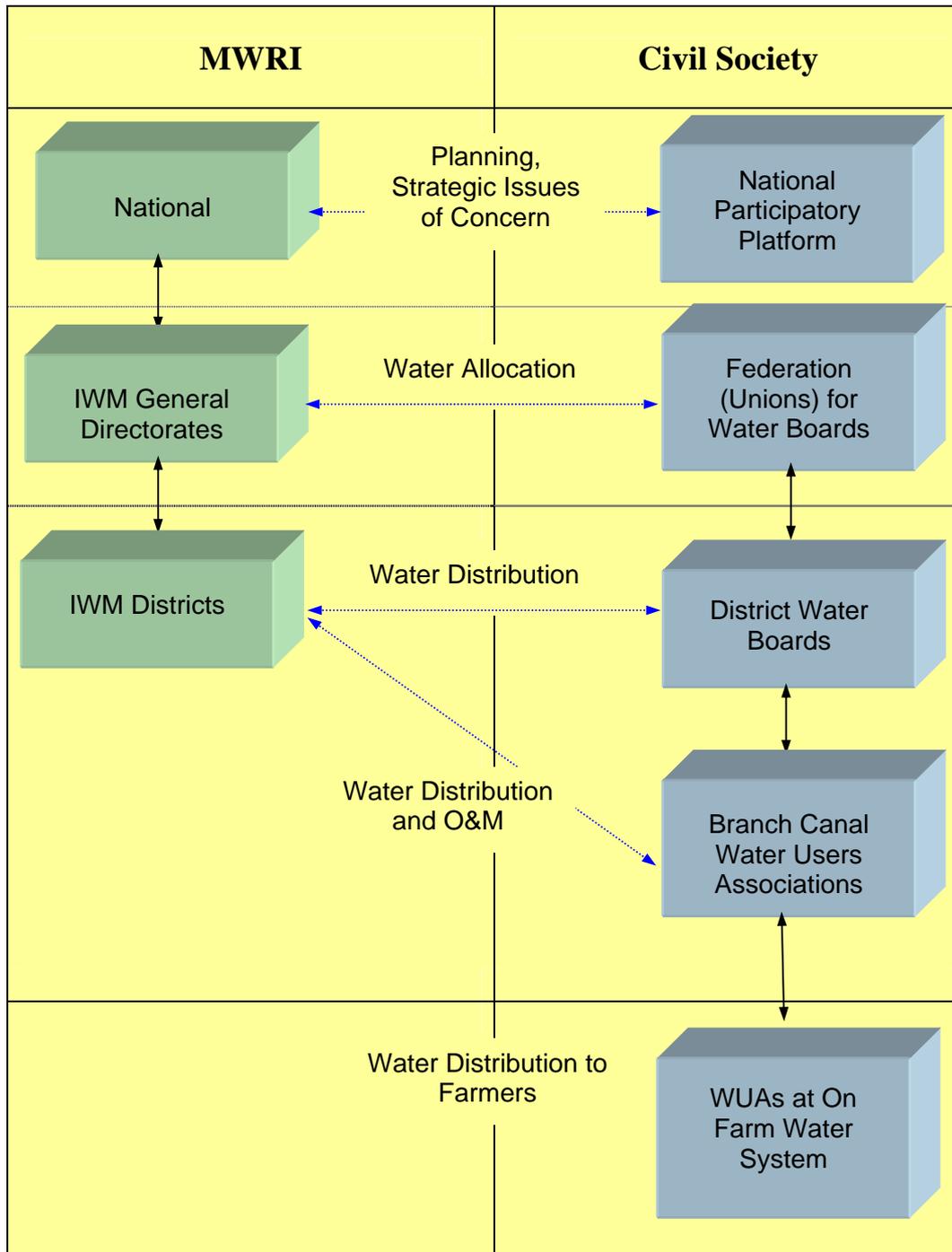


Figure 5. Short to Medium Term Proposed Institutional Setup

The MWRI is considering mechanisms for Irrigation Management Transfer (IMT) in the new lands through the establishment of holding companies and its subsidiaries. Two holding companies for the South Valley and El Salam canal projects have been formed to provide appropriate services to investors, small farmers and university graduates. The holding companies require intense capacity building to be fully functioning. Moreover, the two companies are challenged by the need to write-off the domestic debts and to streamline their roles with respect to the MWRI. Private sector and capable water user associations effective participation in water management are also foreseen for the long term.

Following the previous rational the coming actions are proposed as interventions for institutional reorientation and strengthening:

Summary of Institutional Reform and Strengthening Actions	
1	Finalize a Vision for Institutional Reform for MWRI (ST- 2005)
2	Prepare an Action Plan for Implementation of Institutional Reform Vision (ST-2005)
3	Establishment of National Water Council (or a strategic level committee) (ST to MT – 2006 -2008)
4	Establishment of Integrated Water Management Regional Administrations (MT- LT: minimum of 2 RWMA by 2010, further RWMAs to be considered for LT)
5	Establishment of Integrated Water Management General Directorates (All through: one IWMGD by 2007, at least four IWMGD by 2012, further WMAs to be considered LT)
6	Establishment of Integrated Water Management Districts (All through: 4 IWMD by 2006, 32 IWMD by 2013, remaining for LT)
7	Establishment of Meska Water Users Associations (ST – MT: 800 WUA by 2008, 2000 WUA by 2013, remaining for LT)
8	Establishing Branch Canal Water User Associations (ST – MT: 90 WUA by 2008, 350 WUA by 2013, remaining for LT)
9	Establishing District Water Boards (All through: 8 DWBs by 2008, 32 DWB by 2013, and remaining LT)
10	Establishing Federation (or Unions) for Water Boards (All through: 2 FWBs by 2008, 8 FWBs by 2013, remaining for LT)

II. Policies and Legislations

Policies and instruments supporting IWRM are explicitly and implicitly expressed within the context of institutional reform vision and action plan, the National Water Resources Management Plan, and several interventions pertaining to the IWRM Plan. Of particular interest are the water allocation policies currently practiced which are summarized as⁴:

⁴ Water Resources Policy Project, 2003.

- Ensuring municipal and industrial water requirements water requirements.
- Adequate share of the available water resources is allocated to the agricultural sector based on the information on the cropping pattern proposed by MALR.
- Adjustment to the allocated water may occur in response to requests from users according to the actual day by day operation of the delivery system.
- Water budget decisions are made at the central level of the MWRI.
- Water allocation is a volumetric based at the main system where each directorate can get its water quota.
- Water delivery to farmers is on rotational basis, with the constraint of maintaining certain water levels in the branch canals.
- Farmers can pump their water requirements from the mesqa when it receives water in its turn.

Many of the current management policies are revised by the IR Vision and re-addressed under the intervention “Physical Interventions for Irrigation and Drainage”. Moreover, the latter are to be tackled through the coming IIIMP at the bottom level of the water system.

This category will rather focus on selected specific actions that are believed to support and apply these policies. Legislative interventions are also proposed to complement the enabling environment for IWRM and its associated institutional reforms. Three specific actions are proposed, namely:

Action 11: Operationalizing the National Water Resources Plan

The MWRI through its Planning Sector “NWRP unit” will start operationalizing the National water Resources Plan through:

1. Translating NWRP into operational plans showing actions to be taken, conditions to be fulfilled, enabling environment to be created, linkages between interventions, priorities to be set and milestones to be achieved.
2. Developing a monitoring system to report on the progress of implementation and the impact of the interventions, through developing performance indicators and bench marks, and a mechanism for reporting by all stakeholders.
3. Conducting an enhanced planning procedure for MWRI to incorporate NWRP in the medium term plans and operational plans of the various departments and sectors of MWRI.
4. Providing support to other ministries to incorporate NWRP in their investment and operational plans in addition to setting priorities for the NWRP measures,
5. Supporting capacity building for establishment of Water and Environment Units in the concerned ministries
6. Developing a pilot plan at governorate level based on NWRP.

Action 12: Mobilizing the Political Will to Support IWRM

Securing political will is intrinsic to the successful implementation and materializing of the different IWRM Plan interventions. A sound program for mobilizing the political will is urgently required. The program may start by addressing few selected parliamentarians, media leaders, and investors who possess the capacity to motivate the political will towards endorsing

IWRM practices. Proponents of the Plan should have strong negotiation skills and be politically savvy. Involvement of highest levels within the MWRI is crucial. External professional assistance may be thought to fulfill the objectives of the program. A parallel effort within the Cabinet of Ministers has to be considered.

Action 13: Necessary Amendments / Ratification to Water Sector Legislations

Legislative interventions are required to establish the different components of the proposed institutional setup, to empower civil society organization to undertake O&M services, and to implement cost recovery mechanisms. The necessary actions are summarized below:

- a) *Ratification of the proposed amendments to Law 12/1984, (articles 33, 34, and 35):* These are both necessary and sufficient to :
 - Authorize Meska WUAs to O&M services, charge, collect, retain, and spend O&M and administrative costs from their members.
 - Constitute and empower the Water Boards which may consolidate into Branch Canal Command Area Boards, District Boards, and Branch Canal Water User Associations as corporate entities. The boards will be licensed by MWRI, which is expected to set Memorandum of Understanding (MOU), which the boards will have to meet as preconditions for transfer of defined responsibilities, powers, and resources.
- b) *Further amendment and Ratification of Law 12 with respect to system improvement and authorizing WUAs and WBs to carry mandates of capital cost recovery, should that be envisioned in the long term.*
- c) *Appropriate decrees will be needed to constitute the National Water Council, the Regional Water Management Administrations, and the Basin Water Councils.*
- d) *Harmonizing of legislations :* There may be a need, for the long term *to integrate and revise Laws No. 4 (covering environment-wide spectrum) and Law No. 48 (being freshwater-specific) into one unambiguous and implemental law, defining clearly the roles and responsibilities of each agency, and setting standards that are neither too stringent (which is the case now for the Nile) nor too lenient. RWMA's will be expected to enforce the agreed basin water quality targets more forcefully, using either market-based or administrative controls, and may set penalties or costs in excess of the amounts stipulated in national law. Other concerned laws may need consideration for harmony and integration.*

A summary of the actions which are proposed as interventions for *Policies and Legislations*:

Summary of Policies and Legislation Actions	
11	Operationalizing the National Water Resources Plan (ST- 2006)
12	Mobilizing the Political Will to Support IWRM (ST- MT, 2006 - 2009)
13	Accomplishing Necessary Amendments / Ratification to Water Sector Legislations.

III. Physical Interventions for Irrigation, Drainage, and Groundwater Management, and Rural Sanitation

The following interventions are proposed for immediate implementation to complement the process of transition towards integrated water resources management by addressing the key policy, regulatory, and institution development requirements. These proposed physical pilots rely primarily on the envisioned institutional setup resulting from the reform process within the water sector, as highlighted in the previous section

Action 14: Integrated Irrigation Improvement & Management Project

The project is a two-phase multi-donor and cross sectoral operation to be implemented in an area of about 500,000 Feddans. It aims to address integrated infrastructure improvement applying participatory approaches. The first phase of the project, which is scheduled for seven years, will include two full canal command areas (Mahmoudia in Behera Governorate and Meet Yazid in Gharbia and Kafrelsheikh Governorates) with a gross area of 502,000 feddan (211,000 ha) or about 10% of the Nile Delta. The second phase will include the canal command areas of Bahr Tanah in Dakahlia Governorate, Serry in Menia Governorate, and Ramady in Qena Governorate.

The project will serve as a model for integrated command area improvements comprising technical, managerial, institutional, and environmental perspectives. An enabling regulatory framework, clear and decentralized institutional roles, and proper management tools are being developed within IIIMP command areas and beyond.

The project consists of 5 components at a cost of approximately **US\$300 million**:

(a) **Improved and Integrated Water Management.** This component will cover the implementation of irrigation and drainage rehabilitation, improvement and modernization works and programs at all levels of the selected command areas. Subcomponents include: (i) main canal system improvements; (ii) branch canal (secondary) and mesqa (tertiary) system improvements, including electrification for pumping stations (whenever feasible); (iii) marwa (quaternary) system improvements; (iv) open and subsurface drainage network improvements; (v) observation wells to be installed in both command areas.

(b) **Improved On-Farm Water Management.** Experience from the ongoing Irrigation Improvement Project (IIP) suggests that relatively minor incremental investments in on-farm water management improvements could result in substantial incremental benefits. This component will cover (i) on-farm land leveling (when required); (ii) on-farm water management demonstrations; and (iii) irrigation and agricultural advisory and extension services support.

(c) **Institutional Development and Capacity Building.** A major focus of this component will be the proper establishment, expansion and scaling up of WUA functions at the levels of both tertiary and secondary system irrigation and drainage hydraulic units throughout the selected command areas. Defined subcomponents cover: (i) establishment of Water Boards at: (i) secondary system irrigation and

drainage, and ensuring their voice in decision making at District level; and (ii) establishment and mainstreaming of Integrated Water Management Districts (IWMDs).

(d) **Coordination, Management and Integration.** This component will support the coordination and management entities, functions and activities needed for effective planning, implementation and eventual commissioning of irrigation and drainage improvements on the basis of full command areas. It will also promote and facilitate as appropriate the integration of the various functions and contributions, both within the MWRI and between MWRI and other involved and concerned ministries. Subcomponents cover: (i) establishment and operational support for an integrated Project Management Unit (PMU), to be attached to the Minister's office within the MWRI; (ii) establishment and operational support for Regional Coordination Units and project implementation teams to be attached to the PMU, one at each of the two project command area locations; (iii) set up and execution of monitoring and evaluation (M&E) arrangements and programs to assess project impacts and performance; and (iv) assistance with the formulation and facilitation as needed of liaisons and linkages at and between central and local levels that will advance the integration of improvement planning, implementation and management.

(e) **Environmental Mainstreaming.** A project Environmental Management Plan (EMP) will be implemented under this component demonstrating how improvements in water quality can be achieved. EMP activities will address the threats to water quality posed by domestic sewage discharges into the irrigation systems and the problems caused by improper disposal of municipal solid wastes. Major infrastructure investments are not included, but "soft interventions" for rapid low-cost remedies and for providing bases for future successful project area investments are included. These relate to: (i) public awareness and information disclosure campaigns; (ii) performance-based environmental monitoring; (iii) technical studies and management plans; (iv) institutional capacity building; and (v) provision of essential equipment and facilities. In keeping with the project's integrated planning and implementation approach, there will be involvement by the key GOE agencies responsible for management and/or regulation of sewage disposal and solid waste management in rural areas.

A briefing on the background of IIIMP project design is presented in Annex 3.

Action 15: Operational Framework for Rural Sanitation Service Delivery

The Government of Egypt has spent about LE 18 billion worth of investments on wastewater management projects over the past two decades. Operation and maintenance (O&M) costs for the water supply and sanitation sector alone constitute 4% of GOE total recurrent budget. Yet the water quality in the Egypt, generally, did not improve. Impacting health and the quality of life, it also threatens the national strategic plans for downstream reuse of drainage water, a key component in satisfying Egypt's water supply / demand imbalance. Damage costs from poor water quality are estimated at 1.8% of National GDP. It is evident that previous Government programs on sanitation have been planned and implemented in isolation, often leading to geographically fragmented high cost infrastructure projects but with limited visible improvement to the ecosystem.

Most of the organic pollution load in the surface waterways (canals and drains) is attributed to rural areas where 57% of the people live. The root cause of this problem is that the principles of integrated water resources management have not been adherent to the process of improving the water supply to the rural communities. Thus the situation has aroused and is exacerbated because sanitation services always lag behind water supply services. The latter has expanded significantly in rural areas while the former has been biased towards cities and urban areas. The existing rural household toilets have proved inadequate to cope with the increased wastewater flows. This has led to the spillage of wastewater into streets, irrigation drains, and even into nearby canals. The problem has been aggravated by the lack of systematic programs for solid waste management at the rural level. The problem is further complicated by the presence of high water table at several locations thus limiting the feasibility of applying traditional and low cost sanitation methods.

The problems in rural sanitation Egypt may thus be summed up as follows:

1. Failure of existing household sanitation systems to cope with increased wastewater flows resulting from increased drinking water supplies
2. Unhygienic conditions in villages due to growing pollution from solid wastes and wastewater flows in village streets
3. Increasing pollution of water in irrigation drains and canals from wastewater flows and solid wastes
4. Absence of a national program to address the problems.

The Government of Egypt recognizes the need to address rural sanitation issues in a broader institutional and planning context which considers the economic and environmental aspects of rural sanitation, as well as its health and hygiene aspects.

The proposed framework approach, for the first time in the Egyptian context, links access to investment in rural sanitation services to quantifiable water quality (and health) improvements in a given *hydrologic basin*. Moreover, it relies on the *new institutional setup* for achieving its goals. Furthermore, the framework seeks *coordinated planning and joint prioritization of activities among various ministries*, within regional and basin levels. Finally, the framework also relies heavily on the tools of *performance monitoring and benchmarking systems* as a means of creating incentives for ensuring quality of service provision. While principles of cost recovery are inherent to the sustainability of the services, the approach acknowledges that the public benefits most often exceed the private benefits.

Thus, assuming the availability of adequate and sustainable drinking water supplies, the goals of the Framework may be given as follows:

1. **Private household goals:** improved access to hygienic and convenient latrines that provide privacy and safety at household levels in rural areas
2. **Public health goals:** access to a clean and healthful living environment together with healthful behavioral changes, and

3. **Water quality goals:** improved quality of water in irrigation drains and in irrigation canals

The framework is specifically designed to serve the 27,000 small villages that are at present not included in government plans for the delivery of sanitation services. It addresses the identified problems through a coupled top-down / bottom-up demand-responsive process that takes place between two anchor points, one at the national level and the other at the village level.

From the national level, a **top-down demand** is exerted on rural communities, calling for actions aimed at achieving national goals for irrigation water quality, improved public health, and improved household sanitation. Interested villages provide a **bottom-up response** by stepping forward to participate in a national competition for funds under the Framework to undertake improvements in village level sanitation as a mechanism for reducing water pollution sources from villages while at the same time improving public health and household sanitation. This entails providing information that demonstrates their readiness to participate. In so doing, the villages simultaneously exert a **bottom-up demand** for funds from the national level to finance locally initiated projects developed in response to local needs and preferences. Successful villages receive a **top-down response** to their demands; this comes in the form of allocation of funds for local level activities for improved sanitation.

The specific objective of the Framework includes 100% coverage of all houses within each project village with access to improved sanitation services; the provision of effective facilities for wastewater disposal; discontinuation of the practice of discharging untreated domestic wastewaters into irrigation drains, canals, or storm drains; and the provision of cost-effective measures for solid waste management.

The salient features of the Framework include the use of the **hydrologic basin** as the basic geographical unit for managing the quality of water in irrigation drains and canals. It also relies on competition as a means for prioritizing villages for allocation of funds under the Framework. The key local stakeholders in the Framework will be villages, water users associations, Branch Canal Water Boards and the local administration. Stakeholders at the national level are the Ministries of Water Resources & Irrigation (MWRI), Housing, Utilities and Urban Communities (MHUNC), Ministry of Local Development (MOLD) and State for Environment Affairs (MSEA), thereby merging infrastructure provision with ultimate ecosystem improvement goals.

The operational structure for the Framework envisages a Strategic Management Unit at the national level accountable to a Framework Advisory Board. This Management Unit will define the water quality and other national goals to be pursued within each hydrologic basin, and at Branch Canal Water Board command areas and within villages. Actions to be taken at village levels to meet the national goals should, however, be locally initiated and will be in accordance with local preferences.

An integrated program for continual performance monitoring and benchmarking, aimed at creating an incentive for good performance at village levels and at Branch Canal Water Board levels, is a key element in creating both the incentives and public disclosure mechanisms for achieving, monitoring and sustaining agreed water quality

and health goals. The framework proposes a piloting phase for testing hypothesis and responses followed by phased grading up to national level. A one year time frame is estimated for operationalize the benchmarking program with one water board. A five year time frame is next estimated for operationalizing benchmarking system in fifty water boards and creating investment and capacity building support fund tied to performance and benchmarking ranking. The following ten years are envisioned for extending the framework to 90% of targeted villages.

Action 16: Flow Calibration Program for Irrigation / Drainage Networks

This program is considered a crucial step towards achieving better control and more equitable water allocations and distribution. The Central Directorate of Water Distribution at the Ministry holds the main responsibility for water allocation and distribution through three General Directorates in Upper, Lower Egypt and Greater Cairo. These offices distribute and deliver water to main canals and irrigation directorates. Irrigation Directorates are responsible for allocating water to Inspectorates that allocate and deliver water to Irrigation Districts. The Districts' Engineers allocate and deliver water to farmers through a rotational water delivery schedule. This rotation is either in two or three turns depending on crop type and physical conditions of the delivery networks.

The released water from HAD is distributed among regions to meet their needs through barrages and Canals. Excess or misuse water goes to the sea through Damietta and Rosetta branches. MWRI has developed standards for crops water requirements in different regions on a ten days interval base. The central Directorate calculates the water quota to each directorate on a 10-days interval base by using a mathematical model called "Nile model". This model considers the indicative cropping pattern for each region, drainage reuse, groundwater use and municipal and industrial water needs. In addition, the model is used to calculate the released water from HAD and along the river at the main barrages considering the lag time and gain and losses of water through Nile reaches (WPRP, 2003).

Relying on water levels for estimating the passing discharge is a common practice. There is an urgent need to recalibrate the control structures on the irrigation (and some times drainage) networks. The proposed program encompasses a comprehensive stage, discharge (and velocity) metering program for the entire network. Accurate estimates of flows will greatly enhance water management, help to resolve conflicts between different administrative boundaries and basins, provide a sound basis for providing continuous flow (replacing the rotational system), provide for better drainage reuse design, and will identify area of mismanagement. State of the art technologies should be implied to save time and provide high quality data. This intervention may be executed within the IIIMP project.

Action 17: Implementation of Two Pilot IWRM Systems for Closed Basins in the Western Desert

IWRM system application to closed basins will be piloted at two selected regions. This intervention is aiming at contribution to economic and social livelihood of the population in areas with vulnerable land and water use in Egypt's closed basins. This will be achieved through the development of the appropriate institutional framework and implementation capacity of both the MWRI and local stakeholders to implement

and manage sustainable land and water utilization. The Western Desert Closed basins are potentially targeted areas. Comparison with traditional old land systems and new land systems will be conducted. Should the new models be successful, they could be replicated widely.

Action 18: A Strategy and Action Plan for Groundwater Utilization in the Eastern Desert

The current intervention addresses the *formulation of a strategy and action plan for sustainable utilization of groundwater resources of the Eastern Desert within an IWRM prospective*. An intensive study program will be adopted to develop a replicable model for demonstrating different approaches to integrate groundwater resources of watersheds into national water budget in arid regions. The program conducts comprehensive studies leading to the development, validation and demonstration of techniques for evaluating the extent of alternative water resources arising from meteoric or fossil origins.

The resulting strategy and action plan will address issues concerning;

1. Identifying and prioritizing areas of high potential for groundwater exploitation (Where are the water resources?)
2. Identifying estimates of available resources (How many resources are present?)
3. Recommending exploitation rates (How much could be pumped?)
4. Estimating time span for sustainable use (For how long can specific rates be sustained)
5. Predicting development Scenarios (What sectors shall benefit, and What type of development can be sustained; agricultural, tourism, mining, industry, etc).
6. Predicting regional environmental impacts associated with development scenarios.
7. Establishing a functioning institutional set up for managing these resources.
8. Achieving public participation and stakeholders involvement
9. Adopting cost recovery mechanisms
10. Applying physical monitoring systems
11. Adopting monitoring of performance systems
12. Integrating new resources into nation water budget

This intervention is believed to serve as a role model to be replicated in similar arid and hyper arid zones. Further details pertaining to the Eastern Desert intervention are presented in Annex 4

Summary of Physical Interventions for Irrigation, Drainage, Groundwater Management and Rural Sanitation	
14	Integrated Irrigation Improvements and Management Project (IIIMP): - BCWBs & IWMD at 2 command areas are fully functioning: (ST – 2008), - On demand (continuous flow) established (MT-2010) - Merged irrigation/drainage improvements are in place to secure adequate drainage water reuse (MT – 2011)
15	Operational Framework for Rural Sanitation Service Delivery in Egypt: - Piloting operationalizing benchmarking program with one water board: (ST – 2006),

- Scaling up to additional 50 WBs in a five years span: (ST – MT, 2008 – 2013)
 - Scaling up to full national level in a seven years span: (MT – LT, 2013 – 2020)
- 16 Flow Calibration Program for Irrigation / Drainage Networks: (ST – MT, 2007-2009)
 - 17 Implementation of Two Pilot IWRM Systems for Closed Basins in the Western Desert (ST- MT, 2006 - 2009)
 - 18 Endorsing and Implementing a Strategy and Action Plan for Groundwater utilization in the Eastern Desert (ST, 2007)

IV. Capacity Building

Numerous efforts are invested in capacity building within the MWRI through different ongoing projects. Major projects with significant capacity building activities include:

- i) The Integrated Water Management Districts Project
- ii) The Fayoum Water Management Project (FWMP)
- iii) The Water Board Project (WBP)
- iv) The Integrated Irrigation Improvement and Management Project (IIIMP).

The capacity for participatory water management will have to be built at all levels of the system. One option is to build capacity from the bottom up, extending and building upon current USAID and Dutch efforts at the Branch Canal and District levels. The other option is to constitute all levels in parallel. In all cases, the previous endeavors are mainly concerned with operationalizing the piloted new institutional setups. The following interventions are complementary to the ongoing efforts while addressing different levels and scopes within IWRM.

Action 19: Standard IWRM Kits for Water User Organizations and Integrated Water Management Districts

Experience from ongoing training efforts within the MWRI and its projects will be consolidated into standardized IWRM Kits tailored for different institutional levels. Each kit will include (depending on the targeted organization):

- i. Basic IWRM principles, approaches and related activities
- ii. The new institutional setup for water management
- iii. Water legislations
- iv. Roles and responsibilities within the intended structure
- v. Water allocations, programming and budgeting
- vi. Irrigation and drainage effective management
- vii. Water quantity and quality monitoring (measurement based management)
- viii. Planning, staffing, budgeting, and reporting.
- ix. Administration
- x. Water management within respective authority
- xi. Consolidated operation and maintenance of the irrigation and drainage systems
- xii. Stakeholders participation

- xiii. Performance monitoring and evaluation
- xiv. Water resources assessment (District and higher levels)

The standard kits will be distributed to members of various organizations and will be used while conducting supplementary training seminars and sessions.

Action 20: National IWRM Training Program

In an attempt to integrate various scattered efforts directed towards training for water management, the MWRI, in collaboration with different research and academic institutes concerned with water resources management, shall design, formulate, and implement a periodical training program for selected IWRM (specific) issues which are believed to directly enhance the efficiency and performance of national water management. The program will follow an agreed upon strategy for training, and will ensure quality control and post-training tracking of changes and training-induced impacts. Specific attention will be devoted to formulating special training programs for the following groups:

- i. Senior Water Managers,
- ii. University Graduates (Engineering/Agricultural/Economics) and
- iii. Water Holding Companies

Action 21: IWRM Certification Program

Due to the wide scope and the diversity of issues pertaining to IWRM (technical, administrative, legislative, institutional, engineering, economic, agriculture, biological...etc) a problem of world-wide common occurrence, is that several personnel, firms, organizations claim to be expert(s) of IWRM while, in fact, they may only be specialists in one (or few) aspects only. On the other hand, governmental institutes, organizations, and even NGOs who are mainly concerned with water management, are only using the terminology of IWRM in a fashion-sense.

There is a need to develop a mechanism for generating qualified personnel whose expertise extend beyond the basic knowledge of IWRM. These can act as IWRM advisory service providers, or can ensure the quality of provided IWRM services when acting on behalf of the client (Governmental agencies, for example).

The IWRM Certification Program is a pioneering attempt aiming at providing a recognized pool of experts in integrated water resources management. The program will comprise the completion of identified basic courses and specific field experience. The program will need extensive preparation, structuring, paper work, approvals of concerned ministries, a leading university, and an initiative group of experts. The program shall encompass several IWRM majors (Economy, Finance and administration, Engineering, Agriculture, Environment, Sustainable development... etc.). Ultimately, holders of IWRM certificate will be more eligible to higher management careers within Governmental institutions. Moreover, holders of IWRM Certificates will be recognized as professional experts and, on the long term, the water sector will provide higher added value to consulting services provided by the latter.

The proposed actions for “*Capacity Building*” are summarized as follows:

Summary of Capacity Building Actions

- | | |
|----|--|
| 19 | Issuing and Distributing Standard IWRM Kits for WUAs, BCWUAs, WBs, IWMDs (ST- 2007 – 2008) |
| 20 | Launching a National IWRM Training Program (ST- MT, 2007 – 2009) |
| 21 | Launching a National IWRM Certification Program (MT-LT, 2010- 2013) |

V. *Technological and Information Systems*

Smooth and transparent flow of information between various stakeholders within the water sector is indispensable. Creation of interactive data basis and information systems is a crucial tool for proper IWRM implementation and planning processes. Application of state of the art technologies for data analysis, design, modeling, prediction, planning...etc is essential for enhancing the status of integrated water management. Of particular interest is remote sensing, geographical information systems, system analysis techniques, environmental assessment methodologies, hydrological and hydrogeological modeling tools. The following actions are proposed to serve the former concerns.

Action 22: IWRM Information Center

Building on existing efforts for information management within the Ministry of Water Resources and Irrigation and following the previous discussion in section 2.6.6, the MWRI will host an IWRM Information Center. The Center will be mandated with compiling, analyzing, and disseminating information relevant to water management. The system will comprise numerous information layers at different accessibility levels starting from public domain layers, to restricted access layers and comprising data relevant to the different components of the new institutional setup. The center will also maintain close coordination with other information centers pertaining to the water sector.

A wide range of data may be covered including:

1. Water availability; supply, demand and sectoral requirements:
 - i. Daily flows (discharge) and water levels (stage) at different levels of the Irrigation network
 - ii. Daily flows at different levels of the drainage network
 - iii. Inflows, outflows, and return flows within basins and between administrative boundaries
 - iv. Groundwater pumping rates
 - v. Agricultural drainage water reuse
2. Administrative data: for WUAs and Water Boards, for Integrated Districts, and Directorates, Holding Companies, service companies, and for the Central Management of MWRI (and other coordinated ministries)
3. General layouts for:
 - i. Irrigation network
 - ii. Drainage network

- iii. Sub-surface drainage
 - iv. Hydraulic structures
 - v. Administrative boundaries
 - vi. Cropping patterns
 - vii. Main industrial consumers and industrial cities
4. Water Quality:
 - i. Periodical water quality parameters at selected monitoring station
 - ii. Water quality indices with different reaches of the Irrigation and Drainage systems
 - iii. Groundwater water quality at monitoring wells
 - iv. Reuse water quality
 5. Water Supply and Waste Water Information:
 - i. At Local level
 - ii. At Basin level
 6. Water for industry
 7. Water for tourism
 8. Civil servants pool and inventory for concerned NGOs

The IWRM Center will be used by numerous stakeholders and has to establish a well-functioning linking facility and information providing mechanism. Coordination and communication at all levels is crucial to the successful operation of this center. Following the system design, a phased implementation plan will be formulated and adopted. Moreover, the Center will eventually represent and act as a service provider to the whole water sector. This necessitates conducting agreements with other information centers and data sources outside the MWRI. Full coordination between different stakeholders (ministries, water supply and sanitation companies, water user associations, water boards...etc) will have to be achieved. The Center may also serve for promoting and assisting dissemination activities.

Action 23: Delineation of boundaries for Integrated Irrigation/Drainage Hydrological Basins

This task is concerned with the delineation of hydrological basins boundaries and compilation of relevant parameters. The basin boundaries will, as much as possible, match Irrigation and Drainage networks, inflow / outflow water resources and will provide the basis for setting administrative boundaries for the new institutional set up. Different layers for administrative boundaries, existing districts and management setup, land use, irrigation water distribution networks, surface drainage networks, tile drainage layouts, water quality monitoring stations, groundwater wells, major and minor water structures, roads...etc will be compiled and processed through a GIS system and a GIS Web-based information system and web site may be generated.

Action 24: Risk Management Strategies

An environmental contingency plan for water resources of Egypt will be formulated to encompassing crisis confrontation strategies, quick interventions, impact vulnerability mapping, risk analysis and management.

Following is a summary of the actions which are proposed as interventions for *Raising Awareness for IWRM*:

Summary for Technological and Information Systems	
22	Establishing an IWRM Information Center (Formulation: ST- 2006, opening : ST – 2007, Full functioning : MT – 2010)
23	Delineation of boundaries for Integrated Irrigation/Drainage Hydrological Basins (ST, 2006 - 2007)
24	Formulating Risk Management Strategies (MT, 2009 - 2010)

VI. Water Quality for Irrigation and Drainage Networks

Major concerns to water quality in irrigation and drainage networks of Egypt are portrayed as:

1. Pathogenic pollution as a result of disposal of untreated municipal waste water into water ways.
2. Increased Salinity due to agricultural drainage reuse
3. Organic and inorganic pollution associated with disposal of untreated or partially treated industrial effluents into water ways (mainly drains) at specific locations and hot spots
4. Pollution resulting from agrochemicals and pesticides
5. Contamination resulting from dumping of solid wastes into water ways.

The MWRI recognizes that improving water quality is top priority and pollution of the irrigation and drainage systems must be reduced. Currently, a national monitoring program is established by the MWRI and the National Water Research Center NWRC (NAWQAM Project⁵). The Ministry of Health operates an operational water quality monitoring program concerned with Nile water quality and water treatment plants. The Ministry of State for Environmental Affairs has also plans for preserving and enhancing water quality and is applying another water quality monitoring program. A Co-ordinated effort of the institutions involved is inevitable. The newly established Water Quality Management Unit at MWRI can significantly contribute to the latter.

At the same time, reuse of agricultural drainage water is foreseen as a strategic alternative to augment water supplies and enhance overall irrigation efficiency. About 14% of Egypt's water requirements by the year 2017 are expected to come from approximately 9.6 billion cubic meters of reused drainage water. Reuse is centrally organized by the MWRI and involves the pumping of water from main drains into main canals taking advantage of situations where the two types of channel cross each other at a few strategic points in the Delta region. This "official" reuse rose from 2.6 billion cubic meters in 1988/89 to levels of 5.0 billion cubic meters in 1998/99.

⁵ As stated in section 2.6.6

The following intervention is proposed to serve as strategic framework for reuse programs and as a general framework for water quality management.

Action 25: National Program for Water Quality Management and Water Reuse

The MWRI will take up the leading role for producing a *long term national strategic program for water quality management*. The program will incorporate all ministries, agencies, and organizations concerned with water quality management. The program will particularly address a strategy and action plan for water reuse in Egypt and will build on the previous and current efforts and experiences gained within adopted environmental programs, for example the NAWQAM. Environmental management will be addressed in an integrated manner within the program in order to control and reduce pollution from different sources including the industrial sector. Introduction of modern pollution management is regarded as a basic component of the program.

The Water Reuse Framework will draft a clear strategy an action plan for drainage water reuse. The action plan for enhancing water reuse will be piloted at selected location before wider dissemination. Another plan for waste water reuse will be also addressed with proposed long term implementation.

Annex 1 presents detailed background and discussions of possible interventions within the program for water quality management and water reuse. A summary of interventions for water quality management for irrigation and drainage networks is nest presented.

Summary of Water Quality Actions

25 National Program for Water Quality Management and Water Reuse: (Drainage Reuse Program: (ST, 2007 – 2008), Wastewater Reuse: (LT, 2013 - 2017), Pilot program: (ST, 2008), Full functioning Water Quality Management System: (MT – LT, 2010 - 2013)

VII. Economic and Financial Framework

The government of Egypt through the MWRI is considering financial sustainability visions for the irrigation sub-sector, including:

- i. The need for assessing the alternative cost-sharing arrangements
- ii. The need to progressively turnover operation and maintenance functions to grass-roots (e.g., water user organizations, water boards)
- iii. The need to establish cost-recovery arrangements between the government and farmers/investors in the new lands for capital and O&M costs.

Currently, the costs of meska irrigation improvement and tile drainage are shared between government and beneficiaries. Farmers repay the cost of the meska pump

through 3-years instalments, and the field watercourse/drain through 20-years instalments. Moreover, capital costs are covered by the MWRI alone.

The following set of interventions is proposed within the context of financial sustainability.

Action 26: Cost Recovery Strategy and Collection Mechanisms for the Irrigation and Drainage Sub-Sector

A comprehensive Cost Recovery Strategy will be formulated and tested by the MWRI based on previous and ongoing studies, financial models, and proposed financial sustainability frameworks. The strategy will comprise clearly identified Collection Mechanisms and defined roles and responsibilities for involved organizations whether belonging to the government or to the civil society.

It is envisioned that the strategy may recommend:

- i. Mechanisms for financial and cost accounting systems at all levels. MWRI will monitor and benchmark the economic and financial performance of individual Regional Water Management Administrations, Branch (or Main) Canal Command Area Boards, and District Water Boards, and use benchmarking data to set limits on user charges. All levels will use cost accounting information to develop equitable charges.
- ii. User's charges will be expected to cover operating costs and contribute to the cost of rehabilitation and improvement works at all levels of the proposed institutional setup. Pollution charges could be earmarked to provide contributions to municipal wastewater improvements or remediation of polluted ecosystems.
- iii. Mechanisms for fees estimation and collection. Most O&M revenues may be retained by the organization, which provides the service, while users will receive a consolidated bill of charges.

Action 27: Model for Empowering WUAs and BCWUAs for Undertaking O&M and Fee Collection for Irrigation & Drainage

The MWRI through the IRU will develop a detailed model for empowering the various units of the proposed institutional structure (WUAs, BCWUAs, DWBs...etc) to progressively undertake the operation and maintenance tasks, fee collection, and perform on the basis of appropriate level of financial autonomy.

Action 28: Public Private Participation Model for West Delta Project

The Government of Egypt seeks to augment direct and indirect investments by the private sector, being one of the pillars towards maintaining sustainable growth. While the government will continue to finance and operate most of the major water infrastructure, many end users and stakeholders are petitioned to promote participation of the private sector in financing, developing and operating the system especially at the local level. The MWRI with the assistance of the World Bank have been preparing for the implementation of a mega project in the West Delta area for PPP in irrigation, involving construction and operation of three major canals.

The Government has been reviewing options to replace groundwater with a surface water for irrigation system at the the selected location. The goal is to minimize if not totally halt the depletion of the groundwater resource. However, there are a number of complexities in achieving this, since realistically the growers cannot be forced to connect to a new surface water system, particularly if they are expected to pay for the cost of service. It is the Government's intent to fully recover the cost of the system and to introduce volumetric tariffs to ensure correct incentives to conserve and utilize water more efficiently.

Moreover, beyond its objective to achieve full cost recovery, the Government also wishes to identify practical ways of involving the private sector in the design, operation and even financing of the new system. While the Government fully endorses the project, it is also keen to transfer as much of the related risks and to assign maximum responsibilities of the operations, maintenance and loan amortization to a private operator. Further details pertaining to the West Delta Project are presented in Annex 2

Together with Chile and Morocco, Egypt will be one of three countries worldwide that adopt such a PPP initiative. Beneficiaries range from small holders to large land owners and investors, and have exhibited a predisposition to share costs of the new infrastructures, and pay tariffs at market rates for the private operator.

Action 29: Comprehensive Public Expenditure Review for the Water Sector

A comprehensive Public Expenditure Review for the Water Sector will be conducted by the Ministry of Finance, with support from the World Bank, to assist in achieving financial sustainability for the whole sector.

The actions which are proposed as interventions for "*Economic and Financial Framework*" are summarized as follows:

Summary of Economic and Financial Framework	
26	Formulating a Cost Recovery Strategy and Collection Mechanisms for the Irrigation and Drainage Sub-Sectors (ST- 2007 – 2008)
27	Adopting a Model for Empowering WUAs, BCWUAs, & WBs for Undertaking O&M and Fee Collection for Irrigation & Drainage (ST- MT, 2007 – 2009)
28	Launching a Public Private Participation Model for West Delta Project (ST, 2005 - 2006)
29	Conducting a Comprehensive Public Expenditure Review for the Water Sector (ST, 2006)

VIII. Research

Research concerning water resources management is divided into academic research and applied research. Academic research explores the physics of natural processes related to the different components of the hydrological cycle and its associated subsystems. Applied research is more oriented towards problem solving of existing water problems.

In general research programs are fragmented and in many cases do not follow a specific plan but is rather dependent on the preference, skills and quality of the researcher himself or herself. Insufficient research funding is another impeding factor. Moreover, research for IWRM, specifically needs to be greatly supported and enhanced and expanded to cover environmental economics, socio-economics, financial sustainability, institutional effectiveness, and participatory management.

There are continuing urgent research needs concerning the processes that govern water supply / demand balance, water use and irrigation efficiency, groundwater dynamics, drainage water quantity and quality, and reuse practices. A change of management from disintegrated to integrated mode must be accompanied by a streamlined research programme. The function of research is to provide a reference for changes, to evaluate the new approaches and to correct ill-designed interventions if that is regarded as appropriate. This is addressed through the following intervention.

Action 30: National IWRM Research Program

A pioneering effort, comprising various stakeholders within the water management / water research community is initiated to integrate nation-wide applied research into a single national program aiming at providing viable solutions and technologies which are capable of effectively confront the current water management challenges. The program will encompass both: applied and field research, numerical and physical modelling, engineering, economical, social, and environmental dimensions.

The following steps are envisioned for launching such program:

1. MWRI (along with MARL, MHUNC, and MSEA) identify priority research areas for short, medium, and long terms.
These may include:
 - Integrated management model for Lake Nasser: including hydrodynamics, sedimentation, reservoir operation, environmental management, climate change scenarios.
 - Local scour and slope stability for water ways
 - Wastewater treatment technologies
 - Water quality restoration and preservation in canals, drains, and lagoons.
 - Techniques for lowering groundwater tables
 - Models for financing the water sector
 - Enhancing productivity per drop of water
 - Community participation in water management

- Public Private Participation Models
 - On farm land and water management
 - Confronting salt water intrusion
 - Water reuse
 - Engineering wetlands technologies
2. Formation of a joint steering committee for the research program
The committee will be responsible for identification of collaborate research partners, formulating the program, and follow up on implementation and progress. The committee will ideally include representatives of leading academic and research institutions, NWRC, and the planning sector of MWRI
 3. Initiate a self-study / self-evaluation assignment among the research entities interested in joining the National IWRM Research Program with the aim of pin pointing the areas of specific expertise and the strength (and weakness) of different entities. The self study, which is similar to accreditation procedures, will include measures to evaluate:
 - Research standard
 - Research facilities standard
 - Technical personnel standard
 - Supporting staff standard
 - Research administration, coordination, and collaboration standard
 - Research budgeting standard
 - Creativity and motivation standard
 4. Conduct agreements with selected academic and research institutions
 5. Approve Research Program and identify a system for performance monitoring indicators
 6. Start implementation.
 7. Review and integrate the produced research findings every two years.

Summary of Research Actions

- 30 National IWRM Research Program:
- Research committee established: (ST – 2005),
 - Priorities for research set: (ST, 2006),
 - MOUs with research partners signed. (ST – 2006)
 - Research Program finalized and agreed (ST – 2007)

IX. Raising Awareness for IWRM

As previously mentioned, confronting challenges to the water sector requires a change in the way water is managed. Business-as-usual scenarios are no longer appropriate and the whole sector has to resort to integrated water management. A comprehensive understanding and a great deal of awareness of IWRM approaches has to be inherent to all sectors of society and government. This will ultimately lead to changes in public attitudes when dealing with water resources, changes in management practices, more valuing of water and its ethics, and more participation and involvement in preserving and efficiently utilizing the national water resources.

The interventions proposed under this category include a general national policy and plan for implementing awareness campaigns, and other separate specific awareness activities.

Action 31: Awareness Program for IWRM

A national program will be formulated to coordinate and steer the efforts for raising awareness for IWRM. The program will target all groups belonging to the water sector whether from governmental entities or from the civil society. The program will aim at providing the basic acquaintance with IWRM principles, approaches, and benefits to different stakeholders (NGOs, Farmers, WUOs, MWRI engineers, other governmental officials, investors,...etc.) and motivate the efficient and effective participation in decisions and actions concerning satisfactory Water-related services. This activity will be led by the Water Communication Unit (WCU) and the Central Directorate for Irrigation Advisory Services (IAS) of MWRI. The main awareness themes include:

- Valuing water resources
- Decentralization Policy.
- Privatization/Public Private Partnerships.
- Private Sector Participation.
- Restructuring Requirements and functional activities of various WUAs, WBs...etc
- Legislations and regulations

The program formulation will be based on:

- Survey of ongoing awareness activities within the Ministry and related reports and material including that published through the known media and electronic dissemination.
- Participatory dialogues between the MWRI and the potential stakeholders at the grass root levels.
- Consultations with NGOs and donors community

Tailored awareness programs for each target group containing the proposed methodology; tools, key players, and activities will be formulated. A system for monitoring of performance and success indicators will be developed and applied for M&E of the IWRM Awareness Program. The tools to be adopted and means to be used for information dissemination and awareness are then selected. These include:

1. Personal Communications (Seminars, small group discussions including district engineers and farmers, communication with stakeholders...etc.)
2. Mass media means such as TV and Radio channels.
3. Field visits and discussion forums.
4. Website on the Internet
5. Documentary films illustrating the different challenges facing the water sector in Egypt and how to tackle them, with emphasis on IR.
6. Public seminars on the national and regional scales

Action 32: Quarterly/Periodic Awareness Conferences

MWRI will lead the water sector to consolidate its awareness/dissemination efforts into four periodical quarter annual conferences. Each conference will address a

separate theme for water management (or a separate service category, or even a separate sub-sector). Proposed themes may be:

- i) Irrigation Services, water distribution, cost recovery
- ii) Drainage and On-farm Water Management,
- iii) Groundwater and Non-conventional Water Resources Management, and
- iv) Water Supply and Sanitation, Water Quality.

The conferences will be held at exactly the same dates of each year and will serve different purposes:

- Provide a good opportunity for dissemination of previous year achievements, programs, problems....etc.
- Provide for public hearing events where hot issues, future plans, and proposed interventions may be presented and discussed
- Provide excellent forums for stakeholders motivation and participation

Action 33: Monthly Media Discussions for Emerging Issues Pertaining to Water Management

The MWRI through its water media unit, will organize and provide material for a monthly TV discussion circle for hot issues pertaining to water management. Several messages concerning IWRM can be propagated through the show. The show will also accommodate and host other stakeholders within the water sector. It may comprise special sessions for water for food, water for industry, water for tourism, water and energy, water and environment, water valuing, water education,...etc. The program may occasionally include water-related competitions and contests to stimulate public participation.

Following is a summary of the actions which are proposed as interventions for *Raising Awareness for IWRM*:

Summary of Raising Awareness for IWRM Actions

- 31 Formulating and Implementing a National Awareness Program for IWRM (Formulation: ST- 2006, Implementation: MT – 2008)
- 32 Conducting Quarter Annual Periodical Awareness Conferences (ST- MT, 2006 - 2009)
- 33 Broadcasting a Monthly TV Discussion Show for Hot Issues Pertaining to Water Management (ST- MT, 2006 - 2009)

X. Monitoring and Evaluation

Monitoring and evaluation in this context refers to monitoring of trends and approaches towards IWRM implementation within the perspective of each

intervention and its associated actions, and performance evaluation of implementation process. Thus it is intended to measure the performance in achieving each goal and objective of the relevant intervention. Through monitoring and evaluation, progress towards goals and objectives can be tracked and lessons captured and shared to improve performance. The process usually means involving stakeholders in designing and conducting the evaluation to ensure that the needs, concerns and ideas of different actors are expressed and considered. Following GWP, a good monitoring and evaluation system should be practical and relevant, providing information that is useful and reflective, which means learning from failures as well as successes. Monitoring and evaluation should not be regarded as a faultfinding process but as a beneficial tool that mobilizes commitment and fosters improvement.

Several methodologies can be applied for Monitoring and evaluation. *Continual performance monitoring and benchmarking (CPMB)* is one recommended methodology for performance evaluation. The CPMB will aim at providing appropriate incentives to motivate all stakeholders, communities, and key players to participate and contribute effectively towards all accomplishing targets.

CPMB is characterized by:

- It is an instrument that stimulates the achievement of goals
- Its focus is on results, not just on the means of getting results
- It recognizes that an assessment and discussion process involving various stakeholders is essential for transforming measurement of results into actions for continual improvement
- It embeds information from performance evaluation into critical decision making processes of the management.
- Performance is measured continually to ensure that a performance-driven culture is institutionalized.
- It stimulates collaboration between stakeholders in a friendly environment.

The following interventions are relevant to M&E.

Action 34: IWRM Implementation Follow up Unit

A technical secretariat will be established within MWRI to follow up on the implementation of the IWRM plan. The secretariat will be mandated for:

1. Operationalizing the IWRM plan.
2. Translating the IWRM interventions into operational plans ready for implementation or project documents seeking funding. The process will include budgeting and time scheduling. Moreover, it will comprise financial agreements, plans for staffing, inception reporting, formation of steering and management committees, benchmarking...etc
3. Dissemination of the IWRM plan.
4. Coordination and communication among various stakeholders pertaining to different interventions.
5. Documentation
6. Periodical review and adjustments to the plan.

Action 35: Bench Marking and Success Indicator Scheme for IWRM Plan

A monitoring and evaluation system including bench marking and success indicators will be designed and applied for performance evaluation. Two levels of performance will be assessed:

- Evaluation of IWRM Plan implementation.
- Evaluation of performance for individual interventions.

Action 36: Public Participatory Platform

Intrinsic to the operationalization of the IWRM plan is to provide for an associated *participatory platform* entailing a wide range of forums, informal meetings, workshops, consultation processes, public meetings, focus group interviews, policy dialogues, round tables, and media events. The platform will allow for an interactive dialogue with different groups, and will enhance meaningfully contribution and involvement in the implementation of the Plan. Such a platform should encourage a continuous refining of aims, objectives, and activities.

The setup is ideally coordinated through a competent NGO or a Water Partnership of established record of involvement with the water sector.

Action 37: Bench Marking Programs for Specific Water Sector Institutions (EPADP, IIS)

Detailed Benchmarking and performance evaluation programs will be conducted to monitor the institutional performance, among others, of two major water sector institutes. These are the EPADP and the IIS.

Summary Monitoring and Evaluation Actions

- | | |
|----|--|
| 34 | Establishment of IWRM Implementation and Follow up Unit
- Technical Secretariat assembled and functioning: (ST, 2005)
- Operational plans and project documents finalized (ST, 2005 – 2006) |
| 35 | Bench Marking and Success Indicator Scheme for IWRM Plan:
- Performance indicators for IWRM Plan are agreed upon (ST, 2005),
- Performance indicators for all interventions within IWRM Plan are agreed upon (ST, 2006), |
| 36 | Provide a public participatory platform through a competent NGO
- Long Term program, Agreement with NGOs by 2006 |
| 37 | Establish benchmarking programs for specific water sector institutions (EPADP, IIS) – ST: 2007, 2008. |

XI. Trans-boundary Cooperation

The Government of Egypt through MWRI and MoFA is maintaining high level communication, coordination, and collaborative efforts with the Nile riparian. The Nile Basin Initiative (NBI) presents a role model for a framework of cooperation within basin level integrated management prospective, which seeks for achieving win/win situations.

Action 38: The Nile Basin Initiative

The Nile Basin Initiative programs aim at: poverty alleviation, livelihood standard improving, pollution abatement, and sustainable development of all Nile Riparian Countries. Among the Shared Vision Programs (SVPs) that consider the Principle of Integrated Water Resources Management (IWRM) gaps in all the basin countries are: Nile Basin Transboundary Environmental Action; Water Resources Planning and Management; Applied Training; and Socio-Economic Development and Benefit-Sharing. A list of SVPs with there implementation status is presented in the Table 2.

Table 2. Overview of Nile Basin Initiative Programs

PROGRAM	COMPONENT	Status
Shared Vision Program (SVP)	1. Nile Basin Transboundary Environmental Action	Started
	2. Nile Basin Regional Power Trade	Short Term
	3. Efficient Water Use for Agricultural Production	Short Term
	4. Water Resources Planning and Management	Started
	5. Confidence Building & Stakeholder involvement (Communication)	Started
	6. Applied Training	Started
	7. Socio-Economic Development and Benefit-Sharing	Started
Subsidiary Action Programs (SAP)	Nile Equatorial Lakes (NELSAP)	
	Eastern Nile (ENSAP)	
NBI Facilitation & Program Management	On-going support to facilitate NBI progress and development SVP Program coordination, quality assurance, and monitoring	

The Eastern Nile Subsidiary Action Program (ENSAP):

The Eastern Nile Subsidiary Action Program (ENSAP) currently includes the countries of Egypt, Ethiopia, and Sudan. The Eastern Nile riparians recognize that potential investments need to be assessed within a regional context and that benefits of a win-win nature are most likely to be found in the bundling of projects within a multi-purpose context. The Integrated Development of the Eastern Nile (IDEN) Project includes seven (Short Term) major sub-projects. Majority of these projects

had been launched already and the few remaining will be launched very shortly. IDEN sub-projects are listed below:

- Eastern Nile Planning Model Sub-Project (Started)
- Baro-Akobo Multi-purpose Water Resources Development Sub-Project (Short Term)
- Flood Preparedness and Early Warning Sub-Project (Started)
- Ethiopia-Sudan Transmission Interconnection Sub-Project (Short Term)
- Eastern Nile Power Trade Investment Program (Short Term)
- Irrigation and Drainage Sub-Project (Started)
- Watershed Management Sub-Project (Started)

The Nile Equatorial Lakes Region Subsidiary Action Program (NELSAP):

The Nile Equatorial Lakes Region (NEL) includes the six countries in the southern portion of the Nile Basin - Burundi, DRC, Kenya, Rwanda, Tanzania and Uganda - as well as the downstream riparians Egypt and Sudan. The objectives of NELSAP are to contribute to the eradication of poverty, promote economic growth, and reverse environmental degradation. NELSAP sub-projects are expected to be implemented in the (Short Term for all). Twelve NELSAP projects, as listed below, have been identified by the Nile Equatorial Lakes riparians in a consultative manner, targeting investments in agricultural development, fisheries development, water resources management, water hyacinth control, and hydropower development and transmission interconnection.

Natural Resources Management

- Enhanced Agriculture Productivity through Rainwater Harvesting, Small Scale Irrigation and Livestock Management (Short Term).
- Fisheries Project for Lake Albert and Lake Edward (Short Term).
- Development of a Framework for Cooperative Management of the Water Resources of the Mara River Basin (Short Term).
- Kagera River Basin Integrated Water Resources Management (Short Term).
- Development of a Framework for Cooperative Management of the Water Resources of the Malakisi-Malaba-Sio River Basins (Short Term).
- Water Hyacinth Abatement in the Kagera River Basin (Short Term).

Hydropower Development and Power Trade

- Rusumo Falls Hydro-Electric Power (HEP) Development (Short Term).
- Ranking and Feasibility Study of HEPs in the NEL Region (Short Term).
- Interconnection between Kenya and Uganda (Short Term).
- Interconnection between Burundi, DRC, and Rwanda (Short Term).
- Interconnection between Burundi and Rwanda (Short Term).
- Interconnection between Rwanda and Uganda (Short Term).

Action 39: Capacity Building Program For Nile Basin Countries

An elaborate and diversified capacity building program is implemented to serve the needs of the Nile Basin riparians. The program includes conducting training seminars, short courses, work shops, field visits and expert group meetings. Topics cover all IWRM principles.

Summary of Trans-boundary Cooperation

- | | |
|----|---|
| 38 | The Nile Basin Initiative: (activities started or will start on ST, 2005) |
| 39 | Capacity Building Program for Nile Basin Countries: (ST, 2005 - 2008) |

4.2 Operationalizing the Plan

The following measures are essential for setting the stage for immediate implementation of the IWRM plan:

4.2.1 *The Management Setting*

The basic management setup will comprise a Technical Secretariat (TS) within an existing central unit. The Planning sector and the Minister's office are two potential hosts. As described previously, the initial mandate for such a unit will include: Translating the IWRM interventions into operational plans ready for implementation or project documents seeking funding, Dissemination of the IWRM plan, Coordination and communication among various stakeholders pertaining to different interventions, Documentation, Periodical review and adjustments to the plan.

In addition, the TS will be supported through a competent NGO or a Water Partnership of established record of involvement with the water sector. This associated *participatory platform* will entail a wide range of forums, informal meetings, workshops, consultation processes, public meetings, focus group interviews, policy dialogues, round tables, and media events.

4.2.2 *Monitoring and Evaluation*

In order to monitor initiation and achievements of activities within the IWRM plan, a set of monitoring and evaluation indicators will need to be developed. Within this context, it is anticipated that MWRI will be supported through various donor agencies in this effort to design and implement a sound system. This is a crucial first step in the operationalization process described above.

Table 3. Matrix of IWRM Interventions

Issues		Actions	Short Term 2005 2008	Medium Term 2008 2013	Long Term 2013 2020	Indicators
I. Institutional Reform and Strengthening	1	Vision for Institutional Reform for MWRI				IR Vision adopted (2005)
	2	Action Plan for Implementation of IR vision				IR Action Plan endorsed (2006)
	3	Establishment of National Level Water Council				NWC established and functioning (2007)
	4	Establishment of IWM Regional Administrations				2 RWMA functioning (2010)
	5	Establishment of IWM General Directorates	1			An IWMGD functioning (2007) Four IWMGDs (2012)
	6	Establishment of IWM Districts	8	32		4 IWMD functional (2006), 32 IWMD (2015)
	7	Establishing Meska WUAs	8000	20000		8000 WUA functioning (2008), 20000 WUA by 2013
	8	Establishing Branch Canal Water User Associations BCWUAs	1700	5000		1700 functioning WUA (2008), 7000 functioning WUA (2013)
	9	Establishing District Water Boards	8	80		8 DWBs functioning (2008), 80 DWB functioning (2013)

	10	Establishing Federations (or Unions) for Water Boards	2	8		2 FWBs functioning by 2008, 8 FWB functioning by 2013
II. Policies and Legislations	11	Operationalizing the National Water Resources Plan				Prioritized measures (2005), Operational Plans for NWRP (2006), Benchmarking Program Plan (2006)
	12	Mobilizing the Political Will to Support IWRM				Political Will Program adopted and responsibilities set (2006), IWRM gaining full political support at Cabinet of Ministers by 2006 and at the Parliament by 2009.
	13	Necessary Amendments / Ratification to Water Sector Legislations (12, 48, 4, and specific Ministerial and Presidential Decrees)	Law 12	Appropriate decrees	Law 4, 48	- Law 12 amendments for arts. 33, 34, 35 are ratified by 2006, - Laws 4, 48 amended and ratified by 2008, - Decree for establishing National Water Council issued by 2007

III. Physical Interventions for Irrigation, Drainage, and Rural Sanitation	14	Implement Integrated Irrigation Improvements and Management Project	IIIMP	IIIMP	IIIMP 2	<ul style="list-style-type: none"> - BCWBs & IWMD at 2 command areas are fully functioning by 2008, - On demand (continuous flow) established by 2010 - Merged irrigation / drainage improvements to secure proper drainage water reuse by 2011
	15	Implementing the Operational Framework for Rural Sanitation Service Delivery in Egypt				<ul style="list-style-type: none"> - Piloting operationalizing benchmarking program with one WB : (ST – 2006), - Scaling up to further 50 WBs : (ST– MT, 2008 – 2013) - Scaling up to full national level: (MT–LT, 2013 – 2020)
	16	Flow Calibration Program for Irrigation and Drainage Networks				All rayahs, Nile and its 2 branches are surveyed by 2008
	17	Implementation of two pilot IWRM system for closed basins				<ul style="list-style-type: none"> - Project document formulated and accepted by 2006, - Pilot areas agreed (2006)
	18	Issuing a strategy and action plan for Groundwater utilization in the Eastern Desert				<ul style="list-style-type: none"> - Methodology for Assessment of GW finalized by 2006 - Strategy endorsed by 2007 - Action Plan starts (2008)

IV. Capacity Building	19	Issuing and Distributing Standard IWRM Kits for WUAs, BCWUAs, WBS, IWMDs				Standard kits produced by 2007 Standard kits are widely used for training seminars
	20	Launching a National IWRM Training Program				Agreement among partners by 2007, Periodical Training conducted as of 2009
	21	Launching a National (Regional) IWRM Certification Program				Project Document Produced by 2009, Approvals and Ratification by 2011, Functioning Program by 2013
V. Technological and Information Systems	22	Establishing an IWRM Information Center				- Setup agreed by 2006 - Soft opening on 2007 - Full functioning by 2010
	23	Delineation of boundaries for Integrated Irrigation / Drainage Hydrological Basins				Hydrological Basins clearly delineated by 2007
	24	Risk Management Strategies				- Contingency plan approved by 2010
VI. Water Quality	25	National Program for Water Quality Management and Water Reuse				- Drainage Reuse Program adopted (2007) - Pilot Program initiated (2008) - Functioning Water Quality Management System (2011) - Wastewater Reuse plan (2017)

VII. Economic and Financial Framework	26	Formulating Cost Recovery Strategy and Adopt Collection Mechanisms for the Irrigation, Drainage, and water supply and sanitation subsectors				<ul style="list-style-type: none"> - Strategy Produced by 2007, - Collection Mechanisms identified and tested by 2009
	27	Adopting Model for Empowering WUAs and BCWUAs, and WBs for Undertaking O&M and Fee Collection for Irrigation & Drainage				Model finalized and adopted by 2009
	28	PPP Model for West Delta Project				<ul style="list-style-type: none"> - PPP Model finalized by 2006 - Tendering by 2007 - Implementation starting 2008
	29	Comprehensive Public Expenditure Review for the Water Sector				PER issued by 2006
VIII. Research	30	Adopting an IWRM National Research Program				<ul style="list-style-type: none"> – Establishment of research committee by 2005, – Priorities for research set by 2006, – MOUs with research partners signed by 2006 – Research Program finalized and agreed by 2007 – At least 10 students registered for MS or Ph.D. addressing IWRM relevant issues by 2008

IX. Raising Awareness for IWRM	31	National Program for IWRM Awareness				Awareness program endorsed by MWRI by 2006, Effective stakeholder participation by 2009
	32	Quarter annual periodical awareness conferences (Irrigation, Drainage, Groundwater, WS&S)				4 periodical annual conferences are successfully conducted as of 2008
	33	Establish Media outreach program for emerging issues pertaining to water management				A TV show with relatively public acceptance is broadcasted as of 2007
XI. Monitoring and Evaluation	34	Establish an IWRM Implementation Follow up Unit				<ul style="list-style-type: none"> - Technical Secretariat is assembled and functioning by 2005 - Operational plans and project documents finalized by end of 2005

	35	Establishing Bench Marking and Success Indicator System for IWRM Plan				<ul style="list-style-type: none"> - Performance indicators for IWRM Plan agreed (2005) - Performance indicators for all interventions within IWRM Plan are agreed upon (2006),
	36	Provide a Public Participatory Platform through a Competent NGO				<ul style="list-style-type: none"> - Agreement with NGOs by 2006
	37	Establish Bench Marking Programs for Specific Water Sector Institutions (EPADP, IIS)				<ul style="list-style-type: none"> - Calibration setup approved (2007) - Measuring & calibration assignments starts for Nile, branches, and Rayahs (2008)
XI Transboundary Cooperation	38	Implement Nile Basin Initiative Programs				ENSAP operational (2006)
	39	As part of the Nile Basin Initiative, conduct a Capacity Building Program for Nile Basin Riparian Countries				25 participants from Nile Basin countries are annually attending CB activities as of 2006

ANNEX 1

Environmental Management and Water Reuse

Within the context of appropriate environmental management (particularly water quality management), two concerns are worth discussion:

i. Priority Options for Wastewater Treatment Components

When planning for the implementation of wastewater treatment works, it is worth mentioning that the cost of treatment comprises three main cost items estimated at:

- 40% of the total cost of a sanitation project is allocated for the implementation of the sewerage system itself.
- 20% for the lifting pump station.
- 40% is allocated for the treatment works.

Achieving satisfactory treated effluents being the ultimate goal, implementation normally starts with the sewerage collection system followed by the lifting pump station and treatment works being the last stage. In rural areas, however, and where funds are not sufficient to implement the entire wastewater collection and treatment system, it seems appropriate that treatment plants should be first commissioned. At this stage sewerage collection vehicles can dump their collected wastewater into these plants instead of dumping it into the open drainage system without any treatment. Treated wastewater may then be used in irrigation or may be dumped into the drains without causing the hazardous effects as the untreated water. When funds become available, the collection networks can be executed.

The level of treatment, primary, secondary or tertiary, affects significantly the cost of implementation of the treatment facility. Considering the high investment put into the components of the treatment facility, it may be suggested to decrease the pollution load for specific drains just by performing primary treatment. Secondary treatment costs are much more and it does not improve the quality by the same ratio. It has also been noticed that the existing secondary treatment plants are not adequately operated and maintained due to the insufficient financial resources and lack of technical expertise.

ii. Pollution Mitigation

There are several types of non-conventional treatment methods that can effectively assist in reducing the pollution loads within an open drain system. Upgrading the self-purification capacity of open drains by construction of **in-stream wetlands** or by **aeration system using gabions** are examples of attractive non-conventional treatment methods. Construction of in-stream wetlands is considered to be one of the effective methods for reducing contamination of the drains seriously affected by the receipt of sewage effluent. These in-stream wetlands can be constructed in tertiary drains as they can be fully under control. However, it is worth mentioning that the non-conventional treatment methods are difficult to implement in the Middle Delta region. These methods require on site facilities, therefore, it is more appropriate to be implemented

in the remote areas; e.g. the fringes of the Delta. Lagoon treatment can be considered as a better solution, especially near the fringes of the Delta, as the desert environment provides two necessary inputs for effective lagoon treatment, space and energy through sunshine.

The proposed general framework for water quality management will seek to prevent, regulate, control, and treat emissions and effluents in a sustainable manner to maintain water quality to the satisfaction of various intended uses. This framework will incorporate, among its major components, the following:

i. Legislations and Enforcement Mechanisms

Law 48/1982 provides the basic legislative framework for the protection of surface and groundwater against pollution. In the law a distinction is made between the Nile and the irrigation canals which are referred to as “fresh”, and the drains, lakes and ponds, which are referred to as “brackish”. The responsibility for licensing of wastewater discharge is granted to the MWRI, whereas the Ministry of Health and Population is responsible for monitoring of the effluents. Only discharge of treated industrial wastewater is permitted into fresh water bodies, while treated municipal wastewater can only be discharged to “brackish” water bodies. Moreover, the reuse of drainage water is also regulated. Law 48/1982 establishes a fund from the revenues of levies, fines and costs, which can be used for the administration, donations, research and incentives.

The executive regulations of Law 48 provide water quality standards for industrial discharges to the Nile and canals, domestic and industrial discharges to drains and brackish lakes reuse of drainage water to be mixed with canals, and receiving water bodies.

Law 48 of 1982 and its executive regulations have been subject to several reviews to relax the nature of the standards included and their strictness, which hampers compliance and enforcement, the distribution of responsibilities and the relation between this Law and Law 4/1994 for the protection of the environment. Strict enforcement of the present regulations would necessitate extremely high levels of investments by industry and municipalities, which are not foreseen on the short or medium terms. It would also forbid the reuse of treated municipal wastewater. The application of Law 48 needs to become more flexible; adaptations of the Regulations are necessary to convert it into an effective tool in an overall action plan for pollution control.

Environmental compliance and enforcement mechanisms will have to be clearly specified within a phased implementation long term environmental compliance action plan.

ii. Institutional Setup for Water Quality Management

This includes roles and responsibilities for major stakeholders from governmental institutions and from the civil society. The program should encounter activation and

capacity building of environmental units at various levels (districts, directorates, and regional administrations) and integrating efforts provided by the Ministry of Local Administration, Ministry of State for Environmental Affairs, and Ministry of Health. The roles and responsibilities for Water User Associations and Water Boards at various levels will be also identified.

iii. Environmental Awareness

Environmental awareness campaigns will be conducted at all levels and in cooperation with different involved institutions. Assessment of needs, introduction of new technologies, and building sense of ownership among different stakeholders will be addressed.

iv. Water Quality Monitoring

The existing national monitoring plan will be strengthened and expanded. Moreover, a well functioning water quality monitoring system to integrate both aspects of quantity and quality in the management process will be developed. The monitoring system will be sustainable and effective in disseminating information to the concerned stakeholders. The national monitoring system will be catering for trends and planning issues as well as other regular parametric monitoring.

v. Water Reuse Framework

The Upper Egyptian drainage system returns all drain water to the Nile. In the Delta, main drains terminate in Egypt's northern lakes or in the Mediterranean. Provided that adequate drain water quality is maintained, agricultural drainage water reuse does not inevitably result in health hazards, and provided that salinity levels are properly considered, drainage water reuse is an appropriate strategy for increasing water use efficiency.

Official reuse (prior to 1999) amounted to some 5.0 BCM. It is estimated that some 0.65 BCM/year of drainage water is pumped to El-Ibrahimia and Bahr Yousef canals for further reuse. Another 0.235 BCM/year of drainage water is reused in Fayoum while about 0.65 BCM/year of Fayoum drainage is disposed of in Lake Qarun. In the Delta region, the amount of agricultural drainage water reuse was estimated in 1995/96 to be around 4.27 BCM in addition to about 0.3 BCM lifted to the Rosetta Branch of the Nile from West Delta drains. Unofficial reuse has been estimated at 2.8 BCM/year.

While MWRI regulations require that domestic wastewater be treated to strict standards set in Law 48 prior to discharge into agricultural drains, in practice, this control can only be maintained for well-operated wastewater treatment plants. Moreover, domestic wastewater remains a major contributor to the pollution of agricultural drains through the uncontrolled dumping of septage, sullage, and possibly mixed raw sewage on a daily basis at different locations along the drain system, primarily from underserved rural villages

The health hazards posed by municipal wastewater pollution now threaten to undermine the GOE's drainage water reuse strategy. Since MWRI began systematic monitoring of drain water quality in 1999, five of the 29 mixing stations have had to be closed down. The practices of unofficial reuse is harder to control, but participatory water management can contribute to relieving its root causes by reducing inequities in water distribution between canal heads and tails.

The reuse of drainage water from main drains remains problematic unless pollutants from non-agricultural sources, namely from industry and settlements, are controlled. BOD, COD and faecal coliform levels from non-agricultural sources are high, also in those branch drains which also receive pollutants from small industrial enterprises and villages.

At present, the district engineers of EPADP, of the Irrigation Sector and of the Mechanical and Electrical Department (MED) are the decisive actors. EPAPD monitors through the Drainage Research Institute water quality in drains, maintains the off-farm drainage network, decides on closure of mixing stations if water quality is poor, and advises the irrigation district engineers of the Irrigation Sector on mixing ratios. Water quality in canals, namely after being blended with drainage water, is subject to monitoring by the Irrigation Sector, while the operation of the pumping stations is the MED staff's responsibility. The intermediate reuse of drainage water provides a potential role for user organizations at the branch canal level.

ANNEX 2

Preliminary Conceptualization for the PPP model for the West Delta Project

The area located approximately 60 kilometers north of Cairo to the West of the Nile Delta has experienced noticeable growth since the late 1990s when Government allocated land to farmers and allowed them to irrigate these lands from groundwater sources. Today, this area is a flourishing agricultural economy estimated between \$300 million to half billion dollars annually, serving both domestic and export markets in the European Union. Moreover, the area is now home to 500,000 people and provides about 250,000 jobs in the agriculture sector alone; which compensated for fifteen to twenty percent agricultural land and related activities lost due to urbanization in the Greater Delta Region.

However, with the rapid development over the past few years, there has been an excessive exploitation of the groundwater reserves. With about 47% of the total 255,000 net feddans under cultivation, water extraction by the year 2000 reached 870 million m³ annually, or a 36.2% increase in just over a decade. All this poses a serious threat to the agricultural economy and the livelihood of the families that live and work in the area.

To resolve this problem, the Government has been reviewing options to replace groundwater with surface water for the irrigation system. The goal is to minimize if not totally halt the depletion of the groundwater resource. It is the Government's intent to fully recover the cost of the system and to introduce volumetric tariffs to ensure correct incentives to conserve and utilize water more efficiently. Moreover, the Government also wishes to demonstrate practical ways of involving the private sector in the design, operation and financing of the new system. It is also keen to transfer as much of the related risks and to assign maximum responsibilities of the operations, maintenance and loan amortization to a private operator.

There are various models of PPP varying by contract size and period, by the party (government or private) taking the financing/construction/operation risk, and by the respective/favourable financing mechanism. These models include:

1. Devolution of O&M and rehabilitation tasks to parastatal holding companies, and/or to grass-root groups (e.g., WUAs);
2. Service contracts;
3. Management contracts;
4. Lease contracts;
5. BOT (Build Operate Transfer);
6. BOO (Build Operate Own);

The West Delta PPP model is preliminary envisaged as a DBL (Design Build Lease) project. The DBL scheme is foreseen to include a number of proposed features to mitigate certain risks or increase the incentives for a successful transaction. These are summarized herein as:

i. Proposed Features to Mitigate Demand Risks

- A competitive bid for a private operator based on percentage reduction of reference tariff rates for each sector.

- The execution of definitive “connect agreements” with farmers that specify responsibilities of each party.
- A tariff structure such that the minimum tariff will be equal to the pro-rated capital cost of the user.
- The submission of a security deposit by each participating farmer which can also be used by the DBL operator as an additional source of counterpart financing.
- The inclusion of connection incentives such as, the ability of the project to finance on-farm investments as well the public works.
- Concession boundaries will not be fixed such that overtime the private operator can expand the system as water demand falls within the original boundaries.
- Tariff will be differentiated by sector as each will pay its own marginal cost of service.

ii. Proposed Features to Mitigate Design and System Planning Risks

- Linking final design to actual connection program. Once the DBL operator is selected, the agreement will call for finalizing the design of the system, at which point they will be executing connect agreement from growers.
- Flexible construction scheduling. Once the initial equity injection is made, the loan portion will be drawn down very much like a credit line to complete financially viable modules of the entire system.
- Direct Financial Accountability for Over-planning and Creating excess Capacity. The DBL inherently allows for the operator to benefit or suffer the consequences of his own planning. As there will be the inherent incentive to not over-plan or over-build, some minimum project size designation must be included in the bid solicitation.

iii. Proposed Features to Mitigate Operational and Commercial Risks

- Metered volumetric rates.
- Security staff for guarding water theft in open channels.
- Disconnection and reconnection policy with potential withholding of future water allocation.
- Fines on past due accounts.
- Price adjustment mechanisms for legitimate cost increases.

iv. Proposed Features to Mitigate Operation Construction Risks

- Right-of-way access provided in bid document by Government through MWRI.
- Safeguard policies in place (i.e., arrangements for environmental and cultural heritage monitoring and evaluation and international water issues).

v. Proposed Features to Mitigate Foreign Exchange and Financing Risks

- With regard to currency risks, the holding company will book the loan on its own accounts and charge an interest rate premium on the nominal

interest rate to offset any possible losses due to fluctuations of the local currency.

- With regard to financing risks, the government will make full use of IFI lending program to source the debt portion of the financing. In addition, the bid documents will require a specified contribution of counterpart funding from the winning bidder.

vi. Proposed Features to Mitigate Regulatory Risks

- International Finance Institutions (IFIs) can make available a number of guarantee instruments to offset political, regulatory and breach of contract risks.
- The establishment of an effective regulatory body that will oversee compliance with the responsibilities of each party and to ensure that rights of farmers are also protected. Regulatory functions and rules will be specified.

ANNEX 3

Briefing on the Background of IIIMP Project Design

Lessons Learned and Reflected in the IIIMP Project Design

The conceptual approach and design of the project draws on World Bank, KfW, USAID and Dutch cooperation experiences with the implementation of previous water projects in Egypt, particularly the ongoing Irrigation Improvement Project (IIP). The relevant lessons learned are outlined below:

The IWRM approach is essential to sustain the benefits of agricultural productivity and ensure appropriate institutional mechanisms for implementation of irrigation and drainage improvements. MWRI recognizes that better water management is essential for maintaining a viable agricultural sector, while facing increasing demands from other sectors of the economy. On-going Bank-finance technical assistance to finalize the IWRM Action Plan has indicated that water management is best improved by an integrated package of services and technical assistance that respond to user demand. MWRI has also utilized its collaborative programs with Dutch, German and USAID assistance to reassess current organizational structures in order to enhance cost effective delivery of water services. These initiatives have been piloted in selected districts, and the lessons learned are now being mainstreamed through this project.

Beneficiary participation through water user organizations with adequate legal basis is critical. The experiences with mesqa and branch canal level WUAs under the IIP, and of Water Boards under the Water Boards Technical Assistance project financed by the Netherlands Government have been positive, and these elements have been incorporated into the formulation of the project's institutional development design. However, an important caveat is that the legal basis for their empowerment to manage the O&M of irrigation/drainage infrastructure requires amendments to the Water Resources Law 12 of 1984. The process is now underway but the timeframe for approval subject to parliamentary procedures.

ANNEX 4

Water Resources Potential of the Eastern Desert of Egypt

The Eastern Desert of Egypt is a hyper arid region characterized by a dense network of dry wadi systems, which flowed a long time ago. Nevertheless, the region is subject to sporadic precipitation occurring over mountainous areas, particularly close to the Red sea shore and is channeled throughout extensive watersheds as surface runoff and subsurface groundwater flow. Rainfall eventually translates into recurrent flash flooding events characterized by a relatively high intensity of precipitation over short time duration (2-4 hours), and with a relatively long return period. Within these watersheds, networks of minor wadis join into main wadis which ultimately drain into other water bodies, namely the Nile River or the Red sea. Because some of the watersheds collect precipitation over large areas and channel it through few main wadis, substantial amounts of freshwater could potentially recharge the alluvial aquifers flooring these main valleys during sporadic storms. Moreover, ancient precipitation resulted in creation of a *deep* fossil water aquifer (currently known as the Nubian Sand Stone Aquifer). The opening and stretching of the Red Sea resulted into a system of NW trending faults which act as connectors between the deep aquifer (which may reach over a 1000-m depth) and the shallow aquifers of 100 m depth at several planes and locations within the Eastern Desert. A third lime stone aquifer (Carbonate Aquifer) also exists. The current GW utilization is limited to satellite and uncoordinated efforts which may eventually subject the available GW resources to different threats. The MWRI is well aware of this situation and is conducting several measures to confront these challenges through the Groundwater Sector and the Research Institute for Groundwater.

The intervention included in section 3.1.9.5 addresses the *formulation of a strategy and action plan for sustainable utilization of groundwater resources of the Eastern Desert within an IWRM prospective*. An intensive study program will be adopted to develop a replicable model for demonstrating different approaches to integrate groundwater resources of watersheds into national water budget in arid regions. The comprehensive techniques foreseen within the program encompass the use of various geochemical and isotopic techniques, surface and ground water modeling, analysis of satellite images and digital elevation data, seismic and drilling data and field observations. Tasks inferred include rainfall analysis and prediction of design storms, geo-chemical and isotopic analysis of GW samples to determine its age, source, and potential for recharge, soil sampling, infiltration tests, remote sensing tasks to develop co registered mosaics for geology, land use, soil, and elevations of the entire Eastern Desert of Egypt, surface water modeling for all major wadis, computation of recharge to quaternary basins, geophysical tests, groundwater modeling, and exploration of development scenarios. The program will develop and standardize procedures that could be used to accurately estimate the available groundwater water resources, its distribution, quantity, and development potential.

The program is envisioned to apply state of the art technologies for data collection, data analysis, prediction of hydrogeological responses, scenarios' management, and information handling.

ANNEX 5

The National Water Resources Plan NWRP

The following two Tables (A, and B) summarize the measures of NWRP along with responsibilities of stakeholders in implementing these measures

Table A: Responsibility of stakeholders for Water Quantity measures

Table B: Responsibility of stakeholders for Water Quality and Institutional measures

Legend:

- Responsible: the stakeholder has the first responsibility for the implementation of the measure but should co-operate with and/or consult other stakeholders in this process. In the table indicated by the symbol: ●.
- Co-operate: the stakeholder has an important say in the implementation of the measure but is not the first responsible and is expected to work with other stakeholders in this matter. In the table indicated by the symbol: ◦.
- x Consult: the stakeholder has a (minor) interest in the implementation of the measure and should be consulted by the first responsible but does not have a final say in its implementation. In the table indicated by the symbol: x.

**Table A Activities and Responsibilities of Stakeholders
Water Quantity Measures**

Recommended Measures/Actions Water Quantity Management Measures		Stakeholders											Implementation info										
		Nat. Water Council / MWRI	Min. of Water Res. & Irrig.	Min. of Agric. & Land Recl.	Ministry of Industry	Ministry of Environment	Ministry of Housing	Ministry of Health	Ministry of Electricity	Min. of Transportation	Ministry of Planning	Min. of Local Developm.	Ministry of Tourism	NGOs, etc.	WUAs / Water Boards	Directorates/Decent. Org.	Private Sector	No. of the measure	Type of measure	Total investment (in M.E.)	Total recurrent costs (M.E.)	Starting year	Ending year
Develop more resources	Nile	Continue co-operation with the Nile countries	O	●														120	pol+	2,533	237	2003	2017
	Groundwater	Groundwater development Western Desert		●	O												X	35	inv.	3,500	1,400	2003	2017
		Groundwater developm. Sinai and Eastern Desert		●	O												X	119	stud + inv.	807	323	2003	2017
		Development brackish groundwater for agriculture and aquaculture		●	O												X	37	stud / pilot	4	1	2004	2017
	Rainfall/fish fi.	Increase management of shallow groundwater		●	O		X	X							X		X	121	man.	0	14	2004	2017
		Stimulate rainfall harvesting / groundwater infiltration along Northern coast		●	O							O					X	40	inv.	100	6	2004	2017
		Stimulate on-farm rainfall harvesting along Northern coast		O	●							O						41	inv. + man.	0	0	2004	2017
		Flash floods harvesting in Sinai and Eastern Desert		●								O					X	41	study + inv.	531	55	2006	2017
	Desal.	Increase brackish / salt water desalination		O								O					●	49	inv.	800	282	2005	2017
		Continue planned horizontal expansion projects (postponing Middle Sinai development and making further development dependent on availability)		●	O						X						O	95, 112, 123	inv. + pol.	7,750	644	2003	2017
Management and increase efficiency of existing resources	Irrigation efficiency Nile system	Prioritise efficiency measures in effective areas		●	O									O	O		124	pol.	0	0	2003	2017	
		Continue IP in prioritised areas / IIM/P		●	O										O	X	90	inv.	6,700	297	2003	2017	
		Strengthen Irrigation Advisory Service		●	O										O	O	X	71	inst.	0	338	2003	2017
		Apply canal lining in effective stretches		●											O			88	inv.	335	45	2004	2004
		Apply land-leveling with laser techniques		O	●										O	O		36	man.	0	180	2003	2017
		Introduce controlled drainage during rice cultivation		●	O										O	O		57	man.	16	0	2005	2017
		Improve drainage conditions (EPADP)		●	O										O			50	inv.	3,833	1,320	2003	2017
		Apply modern irrigation techniques in new areas		●	O										O			78	inv.	3,003	1,802	2004	2017
		Gradually introduce modern irrigation techniques in oases		●	O										O			82	inv.	143	21	2004	2017
		Control well discharges in desert areas		●													X	99	inv.	0	0	2003	2017
	Water allocation and distribution Nile system	Reduce irrigation supply after rainfall		●											O			122	man.	0	0	2003	2017
		Apply intermediate reuse at appropriate locations		●				X							O	O		51	inv.	63	8	2003	2017
		Prioritise drainage water reuse in selected areas		●	O		O								O	O		115	pol.	0	0	2003	2017
		Allow higher salinity in irrigation water		●	O		O	O								X	114	pol + stud.	94	0	2004	2017	
		Promote cultivation of salt tolerant crop varieties		O	●		O									X	97	man.	8	3	2003	2017	
		Install Water Boards at irrigation district level		●											O	O		33	inst.	pm	pm	2003	2017
		Continue set-up of Water User Associations at mesqa level		●											O	O	X	69	inst.	0	0	2003	2017
		Introduce regional water allocation based on equal opportunities		●	O										O	O	X	93	pol.	0	0	2003	2017
		Introduce water allocation based on fixed annual amounts per feddan		●	O										O	O	X	67	pol.	90	0	2003	2017
		Continue canals and drains dredging and de-weeding		●	O										O	O	X	98	inv.	2,100	0	2003	2017
	Municipal and industrial water	Improve physical infrastructure for proper water distribution		●											O	O		68	inv.	183	49	2003	2017
		Establish MALR/MWRI co-ordination on supply and demand		●	O										O			111	inst.	0	0	2003	2017
		Introduce water delivery contracts between MWRI and Water Boards		●											O			116	man.	0	0	2003	2017
		Train MWRI and WB staff on system operation		●											O			113	cap. build.	1	0	2003	2017
		Rehabilitate barrages and regulators		●					X									32	inv.	2,225	297	2003	2017
		Rehabilitate and further develop pumping stations in river and canal system		●											O			42	inv.	10,021	401	2003	2017
		Maintain and improve High Aswan Dam and Lake Nasser		●														38	inv.	1,765	35	2003	2017
		Continue works on River Banks, Sea shores and Mapping (combined measure)		●														61, 91/2	inv.	1,630	49	2003	2017
		Provide solid waste collection and disposal systems in rural areas		X		X		X				●		O	X	O	O	6	man.	0	0	2003	2017
		Extend aquatic weed biological control		●	X											O	O	X	46	O&M	143	19	2004
Fish	Install / rehabilitate drinking water metering systems					●					O				X	18	inv.	249	104	2003	2017		
	Review price policy for drinking water					●									O	19	pol.	1	0	2003	2017		
	Intensify water conservation awareness campaigns		O			●					O	O				43	man.	90	0	2003	2017		
	Promote water saving technologies in industry				●										O	54	man.	27	0	2003	2017		
	Reduce leakage losses in PWS network by prioritisation					●					O	O				87	inv.	0	2,000	2003	2017		
	Reuse treated wastewater in New Industrial and Canal Cities		O			●					O				O	56	study	0	0	2005	2017		
	Review restriction on cage culture in the Nile and canal system		●	O												75	pol.	1	0	2004	2004		
	Nav.	Improving the navigational channel in the Nile through dredging		O						●					O		60	O&M	0	64	2003	2017	
Research	Study different operations of High Aswan Dam		●													34	study	16	0	2003	2004		
	Study short duration crop varieties			●												44	study	8	0	2003	2017		
	Study salt tolerant crop varieties			●												62	study	8	0	2003	2017		
	Study use of brackish groundwater for aquacult.			●												37	study	0	0	2003	2017		
Fam.	Continue activities Nat Water Research Center		●													96	study	799	16	2003	2017		
	Conduct family planning awareness campaigns						●									129	man.	203	0	2003	2017		

**Table B Activities and Responsibilities of Stakeholders
Water Quality and Institutional Measures**

Recommended Measures/Actions Water Quality and Institutional Reform		Stakeholders													Implementation info									
		National Water Council / MWRI	Ministry of Water Resources and Irrigation	Ministry of Agriculture and Land Reclamation	Ministry of Industry	Ministry of Environment	Ministry of Housing	Ministry of Health	Ministry of Electricity	Ministry of Transportation	Ministry of Planning	Ministry of Local Development	Ministry of Tourism	NGOs/ Community Based Organisation	Water Users Associations/Water Boards	Directorates/Decentral Organisations	Private Sector and Investor Groups	No. of the measures	Type of measures	Total Investment (in Million LE)	Total recurrent costs (in million LE)	Starting year	Ending year	
Water Quality Management Measures	Prevention	Introduce financial incentives to promote clean industrial products	X															4	man.	900	0	2003	2017	
		Start public disclosure pollution control program for industries																	80	man.	0	2	2003	2017
		Introduce compliance action agreements for industries																	101	man.	0	14	2003	2017
		Initiate public awareness campaigns for clean industrial production																	3	man.	6	0	2004	2005
		Initiate water quality awareness campaigns	O																5	man.			2004	2017
		Phase out and relocate polluting industries along vital waters	X																17	man.	0	0	2003	2017
		Introduce load based discharge levies																	9	pol.	0	0	2003	2017
		Strengthen institutions controlling and monitoring industrial pollution	O																107	inst.	0	0	2003	2017
		Encourage use of environmentally friendly agricultural methods																	13	man.	33	24	2003	2007
		Control the production and import of agrochemicals																	31	man.	0	13	2003	2017
	Control the use of organic fertilisers																	??/135	man.	0	0	2003	2017	
	Treatment	Increase municipal sewerage and wastewater treatment	O																10	inv.	51,505	11,279	2003	2017
		Increase drinking water treatment capacities	O																11	inv.	39,748	16,292	2003	2017
		Initiate cost recovery for urban and rural sanitary services																	108	man.	2	0	2003	2017
		Start local action plans on domestic sanitation in rural areas																	103	man.	170	0	2003	2017
		Encourage treatment or pre-treatment of industrial wastewater by industries	O																127	inv.	0	0	2003	2017
		Collect and/or pre-treat industrial wastewater separately	O																102	inv.	2,220	3,010	2003	2007
		Define functions of waterways	O																89	man.	1	0	2005	2005
	Control	Define water quality standards based on receiving water	O																29	pol.	0	0	2003	2017
		Include reduction of human contact with polluted water in local action plans	O																7	man.	0	0	2003	2007
Divert pollution from Northern Lakes																		2	inv.	43	13	2005	2017	
Protect groundwater from pollution in particular around wells																		79	inv.	4	0	2003	2012	
Select proper sources for public water supply		O																1	inv.	38	0	2003	2007	
Provide sewage disposal systems in unconnected areas		X																8	man.	75	0	2003	2007	
Enhance water quality monitoring and information dissemination																		117	inst.	195	3	2003	2017	
Institutional Reform	Institutional I	Train MWRI and WB staff on pollution and water quality																128	cap.	0	0	2003	2017	
		Restructure the role of MWRI																106	inst.	54	0	2003	2017	
	Fin./priv. / co-operation / Planning	Restructure MWRI - establish integrated water management districts																	130	inst.	140	33	2004	2017
		Stimulate Private Sector participation in infrastructure and O&M																	20	inst.	5	0	2003	2017
		Implement systems of cost sharing and cost recovery for all water users																	100	inst.	5	0	2003	2017
		Continue water sector planning as a rolling exercise																	131	pol.	3	3	2003	2017
		Enhance data exchange among different authorities																	132	inst.	3	0	2003	2017
		Co-ordinate investments on the regional and national levels																	109	inst.	7	0	2004	2017
		Establish permanent inter-ministerial High Committee on IWRM (NWC)																	94	pol.+inst.	4	0	2003	2017
		Enhance role of NGO's and Civil Society (e.g. in local action plans)																	133	inst.	2	0	2003	2017